WTCI-179-P

W-8071 - PANYNJ - WORLD TRADE DEPT. -
1 WTC AND 2 WTC - ADA ACCESS TO
PASSENGER ELEVATORS

REVIEW STATUS

Sub-mission#	Response To #	Coordi-nator	TCRU Memo	Approval	Facility Rider	Outstanding Comments	Remarks	Dwg Locn
.03.94)		OMC	05.23.94	05.23.94		7		XIX-D6 SPECS-G-B

THE PORT AUTHORITY OF NEW YORK & NEW JERSEY

M E M O R A N D U M

To: Mr. Eugene Daly, Acting Chief of Planning, WTD
From: Ennala Ramabhushanam
Date: May 23, 1994
Subject: **WTC - ALTERATION APPLICATION W-8071 - PANYNJ, WORLD TRADE DEPARTMENT - 1 AND 2 WTC - ADA ACCESS TO THE PASSENGER ELEVATORS**

Reference: Review Request dated 5/3/94

Copy To: I. Baron, R. Cronin, R. DiChiara, G. Gaeta, T. O'Connor, Job Folder, Chrono Folder

A review of the material submitted with the referenced request has been made.

It is recommended that approval to proceed with construction be given subject to the submission of the items listed below being revised in accordance with the seven (7) requirements listed on the attached rider.

Drawings:

Specifications:

REMARKS: 1) Please see the attachment for a list of drawings recommended for approval.

2) This memorandum was transmitted to the Facility via OA on May 23, 1994.

Ennala Ramabhushanam, P.E.
Manager
Quality Assurance Division

I.D.: W-8071-001
OMC/al
att.

Reviewers:
O.M. Clemente, HVAC and Coordinator; D. Remeta, Architectural; F. Diaz-Balart, Electrical; A. Sirapyan, Structural; G. Pyrpyris, Fire Protection.

RIDER

ALTERATION APPLICATION V-8071

ARCHITECTURAL

1. Drawing A-1, Floor Plan. Please clarify the need for a roll-down grille between the elevator lobby and entrance foyer since this (grille) might trap the elevator passengers in the lobby when the grille is closed, especially during a fire emergency. See Port Authority Tenant Construction Review Manual, latest edition, Section 5-V-P.

2. Drawing A-4, Details, Door Schedule. Hardware set 4 is listed under Door 4, but none is specified in Section 08715, Appendix A of the specifications. Please clarify. 27-157 (C26-110.2).

STRUCTURAL

3. Drawing D-1, Plans 1 and 2. For elevator shaft walls, indicate support details for the wall above the new openings.

4. Drawings A-5 and A-6. Verify that the existing construction is not overstressed due to added loading from new partitions, stone panels, stainless steel panels, thin set granite, etc.

5. Drawing A-7, Section. Show connection details of the stud framing to the existing steel.

ELECTRICAL

6. Specifications, Section 16720 "Fire Detection Alarm System":

   a) Paragraph 1.01. Add that the "Fire detection alarm system" shall comply with the requirements of the NYC Building Code RS 17-3B."

   b) Paragraph 2.01-B. Add that all fire alarm equipment shall bear labels evidencing approval for use in New York City. See NYC Building Code 27-969 (C26-1704.2).

   c) Paragraphs 2.02-F and 3.01A. Revise these paragraphs to specify that all fire alarm system wiring shall be teflon type, colored fire department red, labeled along its length "FIRE ALARM SERVICE," and approved for use in New York City. See NYC Building Code RS 17-3B, Section 6, and RS 17-3C, Section 5.

FIRE PROTECTION

7. Drawing SP-1, Specifications for Sprinkler Work, Paragraph 13, Sprinkler Heads. Revise sub-paragraph c to read as follows: "Sprinkler heads, except in public corridors, shall be centered on the ceiling tiles within +/- 1/2-inch. Sprinkler heads in corridors shall be located in the center of corridors."

ATTACHMENT

ALTERATION APPLICATION W-8071

Subject to compliance with the requirements listed in this memorandum's rider, the following drawings are recommended for approval:

Drawing		
T-1	revised	4/11/94
D-1	revised	4/11/94
A-1	revised	4/11/94
A-2	revised	4/11/94
A-3	revised	4/11/94
A-4	revised	4/11/94
A-5	revised	4/11/94
A-6	revised	4/11/94
A-7	revised	4/11/94
A-8	revised	4/11/94
E-1	revised	4/15/94
E-2	revised	4/15/94
H-1	revised	4/15/94
H-2	revised	4/14/94
SP-1	dated	5/25/93
SP-2	dated	5/25/93
S-1	revised	4/08/94

TENANT ALTERATIONS REVIEW REQUEST

REVIEWER G. Pyrpyris

DATE May 9, '94

Application Number: W-8071

Submission Number : 1

Return Date : May 13, '94

Coordinator : Clemente Ext. 8589

Facility : WTC

Tenant : World Trade Dept

Charge Number : W2 - x - x - ~~[illegible]~~ 848.071

Building Code : NYC

Discipline : Arch., Struct., Elect., HVAC, Plumb., Civil, Geotech, (Fire Prot), Fueling, Envir., Asbestos, Metering, 5kV, _____

Submission : (Plans), (Specs), Calculations, _____ Report, Letter(s)
complete set 15310, 15375, 16720
Previous Rider, Response to Rider, _____

Notes In order to save time, and to avoid misunderstandings, please write your comments as statements, rather than questions, so that they do not need to be re-written by TCRU.

If you cannot reply by the date shown above, please notify the coordinator.

Discipline	Fire Protection
Reviewer	Danny Luey
Date started	5-10-94
Date completed	5-10-94
Review time	
New comments	/
Repeat comments	
Staff concurrence	

The Port Authority of NY & NJ

To: Otto Clemente
From: Danny Luey
Date: May 10, 1994

Subject: Tenant Alterations Review Request
Application No. W-8071 #1
Fire Protection Comments

Dwg. No. SP-1

Revise **Specifications for Sprinkler Work**, 13. **Sprinkler Heads**, C.: "Sprinkler heads, except in public corridors, shall be centered on ceiling tiles within +/- 1/2 inch. Sprinkler heads in corridors shall be located in the center of corridors."

Due 5/23/94

BASE BU ING ALTERATION REVIEW REQ ST
World Trade Department

No.	Routing	Loc.
✓	QUALITY ASSURANCE P. Cooper	51W W/3
	CAPITAL PROGRAMS	
	PLANNING & DESIGN	36S
	E. Daly	W/1
	S.P.Chiao	W/1
	V.Levinson	W/1
	C.Saavedra	W/1
	R.Becker	W/1
	WTC CONSTRUCTION P. Cavanagh	35N W/1
	OPERATIONS B2 RM.211 T.Cancelliere	W/1
	RISK CONTROL R. Earl Rm. 221 TECH CENTER	Z43 W/1
	ASBESTOS F. Boyce	35N W/1

Contract No. WTC 848.071
Contract Name: #1 & 2 WTC ADA ACCESS TO PASSENGER ELEVATORS
Charge No. CW2-848.071
Location: 1 & 2 WTC MEZZ FL.
Date: MAY 3, 1994

Facility: WORLD TRADE CENTER

Dwg.No(s).
See attached
T-1, D-1, A-1, A-2, A-3, A-4, A-5, A-6, A-7, A-8, H-1, H-2, SP-1, SP-2, E-1, E-2, S-1

[ ] SPECIAL INSTRUCTIONS:

Originating Unit: 823

Contact: Alan J. Simmons
Extn: 435 - 7939 36S

Please return no later than: MAY 23, 1994

Supervisor: Louis J. Menno Ext: 435-2967 35N

Submission: 1st [X] 2nd [ ] 3rd [ ] 4th [ ] 5th [ ] 6th [ ] other [ ]

Construction Cost: $ 349,140.—

DESCRIPTION OF WORK: NEW ADA ACCESS THROUGH TOWER MEZZ.

[X] General construction: [ ] Construction limited to:

[ ] Minor work including:

[ ] Architectural [ ] Electrical [ ] Plumbing [ ]
[ ] Structural [ ] HVAC [ ] Sprinkler [ ]
[ ] Other:

THE PORT AUTHORITY OF N.Y. & N.J.
ENGINEERING DEPT. QUALITY ASSURANCE DIV.
OFFICE COPY DESIGN STANDARDS (1)
W – 8071
~~MAY 03 1994~~

RECEIVED
ALTERATIONS APPLICATION
TENANT CONSTRUCTION REVIEW UNIT

ATTACHED ARE:

[ ] BS&A / MEA resolutions [ ] Laboratory test reports for carpeting
[ ] Catalog cuts [ ] Samples [X] Specifications P.A. (1 SET)
[ ] Consultants' responses to Port Authority review comments
[ ] Structural Calcs. [ ]
Remarks:

cc: A. Cracchiolo, R. Cronin, R. DiChiara, D. Karpilloff, P. Marchese, L. Menno, A. Reiss, J. McVeety, _____, _____, _____, _____, _____, _____

Signature: Alan J. Simmons Date: 4/3/94

Alan J. Simmons
Program Manager
Capital Programs Division
World Trade Department

ajs
1/17/94

A REVISED 9/21/89

DIVISION 2

SECTION 02050

DEMOLITION AND DISPOSAL

THE PORT AUTHORITY OF N.Y. & N.J.
ENGINEERING DEPT. QUALITY ASSURANCE DIV.
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W-8071 (1)
MAY 03 1994
6-B
RECEIVED
ALTERATIONS APPLICATION
TENANT CONSTRUCTION REVIEW UNIT

PART 1 - GENERAL

1.01 SUMMARY

A. This Section specifies requirements for demolition and disposal.

B. Retained Items

Prior to demolition, carefully remove, store and protect materials and equipment, if any, shown on the Contract Drawings as "Retain - Deliver to Engineer".

C. Additionally, for Work in the City of New York, prior to demolition employ a certified exterminator and treat entire structure in accordance with governing health regulations for rodent and insect control, as if the Work were being performed for a private corporation.

1.02 DESIGN AND PERFORMANCE REQUIREMENTS

A. The Contractor assumes the risk of any loss due to theft, destruction or disappearance of, or damage to, the structures or portions thereof to be demolished, whether occurring before or after the submission of Proposals on this Contract, arising from any cause whatsoever excepting only affirmative, intentional acts of the Authority.

B. The Authority assumes no responsibility for guarding the structures to be demolished either before or after the Contractor is given access thereto, and does not guarantee that their condition will remain the same after the submission of Proposals as before. The Authority does not imply by this Section that the structures to be demolished are complete structures.

C. Storage or sale of items of salvable value to the Contractor is prohibited on the construction site.

D. Demolition using explosive, incendiary or wrecking ball methods is prohibited.

E. Provide water and wet down the structure(s) being demolished, as well as the sites adjacent to the structure(s) being demolished, to limit raising dust and dirt to lowest practical level. Provide water truck, water line or hydrant connection, and hoses for this purpose.

F. Do not use, or permit the use of, the structure(s) to be demolished for any purpose other than for actual demolition.

G. Do not traverse pavement with tracked vehicles or other equipment which may damage pavement.

H. Do not use heaters without prior approval of the Engineer. Installation of temporary heaters, if used, shall conform to American National Standards Institute (ANSI) A10.10 "Safety Requirements for Temporary and Portable Space Heating Devices and Equipment Used in the Construction Industry".

I. Condition of Adjacent Construction

1. Prior to starting demolition, make an inspection accompanied by the Engineer to determine physical condition of adjacent existing structure(s) or construction that is to remain.

2. During such inspection the Engineer and the Contractor shall mutually agree on existing damage to adjacent existing structure(s) or construction that is to remain, if any, and the Contractor shall subsequently prepare and submit to the Engineer a written description of such mutually agreed upon existing damage, including photographic documentation when requested by the Engineer.

J. Utility Services

1. Do not disrupt service to fire hydrants in any way without the written approval of the Engineer. If, with written approval of the Engineer, water service to any area is disrupted, make provisions to ensure adequate fire protection for such area.

2. At all times during the Work of this Section, maintain accessibility from street to all fire hydrants, traffic signals, power or light poles, mailboxes, and similar utility and public service items adjacent to the construction site.

3. Do not interrupt utilities serving occupied or used areas, except when authorized by the Engineer. Provide temporary services during such interruptions as approved by the Engineer.

4. Arrange in advance of demolition Work for disconnection or rerouting of utility line(s). Identify such capped, plugged, sealed or rerouted lines on a record drawing. Submit such drawing in accordance with 1.03 B.

1.03 SUBMITTALS

A. Submit the following to the Engineer prior to start of demolition Work:

1. Certificates of severance of utility services from the respective utilities;

2. For Work in the City of New York, certification that the structure has been effectively treated for rodent and insect control;

3. Description of proposed methods and operations of demolition, for review and approval by the Engineer;

4. Description of sequence of demolition and disposal Work, for review and approval by the Engineer;

5. Written inspection report described in 1.02 I.2; and

6. Description of proposed method of filtering sediment from runoff, for review and approval by the Engineer.

B. Submit in accordance with the requirements of "Shop Drawings, Catalog Cuts, and Samples", of Division 1 - GENERAL PROVISIONS, a record drawing indicating horizontal and vertical locations of disconnected, rerouted or capped utilities, or filled underground tanks. Reference all such items to visible permanent surface features.

C. For imported fill material, submit to the Engineer of Materials, Engineering Materials Laboratory, Port Authority Technical Center, 241 Erie Street, Jersey City, NJ 07310-1397, one 25-pound, representative sample of such material proposed for use under this Section, subject to the following:

1. Not less than three weeks prior to delivery of imported fill material to the construction site, submit sample in clean sturdy container or bag which shall not permit loss of any material.

2. Clearly label sample with Contract number, title and location, material supplier's name and location and identification of fill material.

3. Do not deliver imported fill material to the construction site until the Engineer has checked and approved the sample of such material.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Imported Fill

Soil materials to be delivered to the construction site by the Contractor, approved in accordance with 1.03 C, shall be as follows:

1. For basements, voids and subbase, soil materials shall consist of stone, gravel, and sand, free from debris, trash, roots and other organic matter, with no particle size exceeding 2 inches in maximum dimension.

2. For tank filling, soil material shall be clean, well-graded sand.

B. Rubble Fill

Rubble fill shall be concrete, brick or other masonry materials resulting from demolition. Break fill material into pieces not exceeding 4 inches in their greatest dimension, with no flat or elongated pieces, with all protruding reinforcing cut or burned off, and with a sufficient percentage of smaller pieces to minimize voids. A flat piece is one having a ratio of width to thickness greater than five; an elongated piece is one having a ratio of length to width greater than five.

PART 3 - EXECUTION

3.01 PREPARATION

A. Protection

1. Erect and maintain temporary window or opening covers, covered passageways, barricades or fences as required to ensure safe passage of persons around area of demolition.

2. Erect and maintain enclosed dust chutes as required for the disposal of materials, rubbish, and debris.

3. Erect and maintain dustproof partitions as required to prevent spread of dust, fumes or smoke to other occupied or used areas or structures.

4. Provide temporary interior and exterior shoring, bracing and/or support as required to ensure that movement or settlement of structures to be demolished is safely controlled and collapse is prevented. Ensure that movement, settlement, and/or damage to existing facilities does not occur.

B. Pollution Controls

1. Use water sprinkling, enclosed chutes and/or temporary enclosures to limit dust and dirt rising and scattering in the air. Conform to requirements of 1.02 E.

2. Filter sediment from runoff before it enters drainage systems or waterways using methods in accordance with 1.03 A.6.

3. Do not use water when it may create hazardous or objectionable conditions such as ice or flooding.

4. Pump out the contents of buried tanks shown on the Contract Drawings. Remove such pumped-out materials and dispose of them away from Authority property by safe means so as not to endanger the health of workers and the public.

C. Authority-Retained Items

1. Remove and handle carefully to avoid damage.

2. Prepare as shown on the Contract Drawings.

3. Deliver to a construction site location designated by the Engineer, unless otherwise shown on the Contract Drawings.

3.02 DEMOLITION

A. Conduct demolition operations and disposal of debris to ensure minimum interference with the use of, or access to, adjacent buildings or construction site areas. Do not unnecessarily obstruct sidewalks or street.

B. Before commencement of demolition remove all glass in windows, doors, skylights and fixtures.

C. Proceed with demolition in a systematic manner, from top of structure to ground. Complete upper demolition before disturbing lower supporting members.

D. Do not store any materials, rubbish, dirt, debris or waste of any sort resulting from the demolition operations on the floor of partially demolished structures, or adjacent construction site areas.

E. Demolish concrete and masonry in small sections. Lower heavy framing members carefully.

F. Where shown on the Contract Drawings, break and remove on grade and basement slabs.

G. Disposal of Demolished Materials

1. Unless otherwise shown on the Contract Drawings, dispose of debris, rubbish, and other materials resulting from demolition operations away from Authority property.

2. On Authority property, do not burn, bury or otherwise dispose of debris, rubbish or other materials resulting from demolition operations.

H. Contractor's Salvaged Materials

Except for items shown on the Contract Drawings as "Retained - Deliver to Engineer", other removed and salvaged materials not shown for reuse or as retained shall become the Contractor's property. Such materials shall be removed from Authority property at no additional cost to the Authority.

3.03 ADJUSTMENTS

A. Unless otherwise shown on the Contract Drawings, provide fill for below-grade areas and voids resulting from the Work of this Section as follows:

1. Fill to be placed one foot or more below grade or paving subgrade, or one foot or more away from foundation walls, edges of footings, or underground utility lines, may at the Contractor's option, be imported soil material or rubble fill as specified in 2.01.

2. Fill to be placed in the remaining one-foot void shall be approved imported soil material conforming to requirements of 2.01 A.1.

B. Place approved rubble fill material in horizontal layers not exceeding one foot in loose depth, with top layer consisting of the smallest size rubble available. Compact each layer of rubble fill with at least four passes of a ten-ton roller, of a type approved by the Engineer.

C. Place approved imported soil materials in horizontal layers not exceeding 6 inches in loose depth. Compact each layer at optimum moisture content of fill material to a density equal to original adjacent ground, unless otherwise directed by the Engineer.

D. Unless otherwise shown on the Contract Drawings, fill buried tanks with approved imported sand conforming to requirements of 2.01 A.2.

E. After placement and compaction of fill, grade surface to meet adjacent contours and to provide surface drainage.

F. Where and as shown on the Contract Drawings, provide for subsurface drainage through slabs on which fill is placed.

3.04 REPAIR

Promptly repair, to the satisfaction of the Engineer and at no cost to the Authority, damage caused to adjacent facilities by demolition and removal operations.

END OF SECTION

SECTION 02073

CUTTING, PATCHING AND REMOVAL

PART 1 - GENERAL

1.01 SUMMARY

This Section specifies requirements for cutting, patching and removal of existing construction.

1.02 QUALITY ASSURANCE

Cutting, patching and removal shall be performed by workers skilled in the specific trades involved.

1.03 SUBMITTALS

Submit to the Engineer proposed methods and materials for cutting, patching and removal, for his approval.

PART 2 - PRODUCTS

2.01 MATERIALS

All materials required for patching shall be new. Patching materials shall match in every respect adjacent portions of the existing construction.

PART 3 - EXECUTION

3.01 EXAMINATION

Prior to cutting, patching and removal, inspect the affected areas and protect all existing and new construction including utilities, finishes and equipment from water, damage, weakening or other disturbance.

3.02 CUTTING, PATCHING AND REMOVAL

A. Perform all cutting, patching and removal in accordance with the approved methods using approved materials.

B. Do not cut or remove more than is necessary to accommodate the new construction or alteration.

C. Maintain the integrity of all construction at all times.

D. Protect finished surfaces at all times and repair or replace, if damaged, to match existing construction to the satisfaction of the Engineer.

E. Do not allow removed materials and debris to accumulate at the site; remove them daily. All areas adjacent to, and leading to and from the site, shall be kept free of removed materials and debris.

END OF SECTION

N

DIVISION 2

SECTION 02075

PARTIAL REMOVALS

PART 1 - GENERAL

1.01 SUMMARY

A. This Section requires the selective removal and subsequent offsite disposal of portions of existing buildings shown on the Contract Drawings and as required to accommodate new construction.

B. Cutting nonstructural floors and walls for piping, ducts, and conduits is included with the Work of the respective mechanical and electrical specification Sections in Divisions 15 and 16.

C. Relocation of pipes, conduits, ducts, and other mechanical and electrical Work is specified in other Divisions.

D. Retained Items

Prior to beginning removals Work, carefully remove, store and protect materials and equipment, if any, shown on the Contract Drawings as "Retain - Deliver to Engineer".

1.02 DESIGN AND PERFORMANCE REQUIREMENTS

A. The Contractor assumes the risk of any loss due to theft, destruction or disappearance of, or damage to, the structures or portions thereof to be removed, whether occurring before or after the submission of Proposals on this Contract, arising from any cause whatsoever excepting only affirmative, intentional acts of the Authority.

B. The Authority assumes no responsibility for guarding the removal areas either before or after the Contractor is given access thereto, and does not guarantee that their condition will remain the same after the submission of Proposals as before. The Authority does not imply by this Section that the structures to be demolished are complete structures.

C. Storage or sale of items of salvable value to the Contractor is prohibited on the construction site.

D. Demolition using explosive, incendiary or wrecking ball methods is prohibited.

E. Provide water and wet down the removal areas, as well as the sites adjacent to the portions of structure(s) being removed, to limit raising dust and dirt to lowest practical level. Provide water truck, water line or hydrant connection, and hoses for this purpose.

F. Do not traverse pavement with tracked vehicles or other equipment which may damage pavement.

G. Do not use heaters without prior approval of the Engineer. Installation of temporary heaters, if used, shall conform to American National Standards Institute (ANSI) A10.10 "Safety Requirements for Temporary and Portable Space Heating Devices and Equipment Used in the Construction Industry".

H. Condition of Adjacent Construction

1. Prior to starting demolition, make an inspection accompanied by the Engineer to determine physical condition of adjacent existing structure(s) or construction that is to remain.

2. During such inspection the Engineer and the Contractor shall mutually agree on existing damage to adjacent existing structure(s) or construction that is to remain, if any, and the Contractor shall subsequently prepare and submit to the Engineer a written description of such mutually agreed upon existing damage, including photographic documentation when requested by the Engineer.

I. Utility Services

1. Do not disrupt service to fire hydrants in any way without the written approval of the Engineer. If, with written approval of the Engineer, water service to any area is disrupted, make provisions to ensure adequate fire protection for such area.

2. At all times during the Work of this Section, maintain accessibility from street to all fire hydrants, traffic signals, power or light poles, mailboxes, and similar utility and public service items adjacent to the construction site.

3. Do not interrupt utilities serving occupied or used areas, except when authorized by the Engineer. Provide temporary services during such interruptions as approved by the Engineer.

4. Arrange in advance of removal Work for disconnection or rerouting of utility line(s). Identify such capped, plugged, sealed or rerouted lines on a record drawing. Submit such drawing in accordance with 1.03 B.

J. Occupancy: The Authority will occupy portions of the building immediately adjacent to areas of selective removals. Conduct selective removal Work in manner that will minimize need for disruption of the Authority's normal operations. Provide minimum of 72 hours advance notice to the Authority of removal activities that will affect the Authority's normal operations.

K. Damages: Promptly repair damages caused to adjacent facilities by demolition work.

L. Flame Cutting: Do not use cutting torches for removal until Work area is cleared of flammable materials. At concealed spaces, such as interior of ducts and pipe spaces, verify condition of hidden space before starting flame-cutting operations. Maintain portable fire suppression devices during flame-cutting operations.

1.03 SUBMITTALS

A. Submit the following to the Engineer prior to start of demolition Work:

1. Certificates of severance of utility services from the respective utilities;

2. Description of proposed methods and operations of removal, for review and approval by the Engineer;

3. Description of sequence of removal and disposal Work, for review and approval by the Engineer;

4. Written inspection report described in 1.02 H.2; and

5. Description of proposed method of filtering sediment from runoff, for review and approval by the Engineer.

B. Submit in accordance with the requirements of "Shop Drawings, Catalog Cuts, and Samples", of Division 1 - GENERAL PROVISIONS, a record drawing indicating horizontal and vertical locations of disconnected, rerouted or capped utilities, or filled underground tanks. Reference all such items to visible permanent surface features.

C. For imported fill material, submit to the Engineer of Materials, Engineering Materials Laboratory, Port Authority Technical Center, 241 Erie Street, Jersey City, NJ 07310-1397, one 25-pound, representative sample of such material proposed for use under this Section, subject to the following:

1. Not less than three weeks prior to delivery of imported fill material to the construction site, submit sample in clean sturdy container or bag which shall not permit loss of any material.

2. Clearly label sample with Contract number, title and location, material supplier's name and location and identification of fill material.

3. Do not deliver imported fill material to the construction site until the Engineer has checked and approved the sample of such material.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Imported Fill

Soil materials to be delivered to the construction site by the Contractor, approved in accordance with 1.03 C, shall be as follows:

1. For basements, voids and subbase, soil materials shall consist of stone, gravel, and sand, free from debris, trash, roots and other organic matter, with no particle size exceeding 2 inches in maximum dimension.

2. For tank filling, soil material shall be clean, well-graded sand.

B. Rubble Fill

Rubble fill shall be concrete, brick or other masonry materials resulting from demolition. Break fill material into pieces not exceeding 4 inches in their greatest dimension, with no flat or elongated pieces, with all protruding reinforcing cut or burned off, and with a sufficient percentage of smaller pieces to minimize voids. A flat piece is one having a ratio of width to thickness greater than five; an elongated piece is one having a ratio of length to width greater than five.

PART 3 - EXECUTION

3.01 PREPARATION

A. Protection

1. Erect and maintain temporary window or opening covers, covered passageways, barricades or fences as required to ensure safe passage of persons around area of removals.

2. Erect and maintain enclosed dust chutes as required for the disposal of materials, rubbish, and debris.

3. Erect and maintain dustproof partitions as required to prevent spread of dust, fumes or smoke to occupied portions of the building and adjacent buildings. Where selective demolition occurs immediately adjacent to occupied portions of the building, construct dust-proof partitions of minimum 4-inch studs, 5/8-inch drywall (joints taped) on occupied side, 1/2-inch fire-retardant plywood on demolition side. Fill partition cavity with sound-deadening insulation.

4. Provide weatherproof closures for exterior openings and for roof areas with exposed, unprotected edges resulting from removals Work.

5. Provide temporary interior and exterior shoring, bracing and/or support as required to ensure that movement or settlement of portions of structures to be removed is safely controlled and collapse is prevented. Ensure that movement, settlement, and/or damage to existing facilities does not occur.

6. Provide bypass connections as necessary to maintain continuity of service to occupied areas of building. Provide minimum of 72 hours advance notice to the Authority if shutdown of service is necessary during changeover.

B. Pollution Controls

1. Use water sprinkling, enclosed chutes and/or temporary enclosures to limit dust and dirt rising and scattering in the air. Conform to requirements of 1.02 E.

2. Filter sediment from runoff before it enters drainage systems or waterways using methods in accordance with 1.03 A.6.

3. Do not use water when it may create hazardous or objectionable conditions such as ice or flooding.

4. Pump out the contents of buried tanks shown on the Contract Drawings. Remove such pumped-out materials and dispose of them away from Authority property by safe means so as not to endanger the health of workers and the public.

C. Authority-Retained Items

1. Remove and handle carefully to avoid damage.

2. Prepare as shown on the Contract Drawings.

3. Deliver to a construction site location designated by the Engineer, unless otherwise shown on the Contract Drawings.

3.02 REMOVALS

A. Conduct selective removals Work and disposal of debris to ensure minimum interference with the use of, or access to, adjacent occupied areas, adjacent buildings, or construction site areas. Do not unnecessarily obstruct sidewalks or street.

B. Remove all glass in windows, doors, skylights and fixtures before proceeding with other required removal Work.

C. Proceed with removals in a systematic manner, from top of structure to ground. Complete upper removals before disturbing lower supporting members.

D. Do not store any materials, rubbish, dirt, debris or waste of any sort resulting from removal Work on the floor of areas to remain or adjacent construction site areas.

E. Remove concrete and masonry in small sections. Lower heavy framing members carefully.

F. Where shown on the Contract Drawings, break and remove on grade and basement slabs.

G. Disposal of Removed Materials

1. Unless otherwise shown on the Contract Drawings, dispose of debris, rubbish, and other materials resulting from removal operations away from Authority property.

2. On Authority property, do not burn, bury or otherwise dispose of debris, rubbish or other materials resulting from removal operations.

H. Contractor's Salvaged Materials

Except for items shown on the Contract Drawings as "Retained - Deliver to Engineer", other removed and salvaged materials not shown for reuse or as retained shall become the Contractor's property. Such materials shall be removed from Authority property at no additional cost to the Authority.

3.03 ADJUSTMENTS

A. Unless otherwise shown on the Contract Drawings, provide fill for below-grade areas and voids resulting from the Work of this Section as follows:

1. Fill to be placed one foot or more below grade or paving subgrade, or one foot or more away from foundation walls, edges of footings, or underground utility lines, may at the Contractor's option, be imported soil material or rubble fill as specified in 2.01.

2. Fill to be placed in the remaining one-foot void shall be approved imported soil material conforming to requirements of 2.01 A.1.

B. Place approved rubble fill material in horizontal layers not exceeding one foot in loose depth, with top layer consisting of the smallest size rubble available. Compact each layer of rubble fill with at least four passes of a ten-ton roller, of a type approved by the Engineer.

C. Place approved imported soil materials in horizontal layers not exceeding 6 inches in loose depth. Compact each layer at optimum moisture content of fill material to a density equal to original adjacent ground, unless otherwise directed by the Engineer.

D. Unless otherwise shown on the Contract Drawings, fill buried tanks with approved imported sand conforming to requirements of 2.01 A.2.

E. After placement and compaction of fill, grade surface to meet adjacent contours and to provide surface drainage.

F. Where and as shown on the Contract Drawings, provide for subsurface drainage through slabs on which fill is placed.

3.04 REPAIR

Promptly repair, to the satisfaction of the Engineer and at no cost to the Authority, damage caused to adjacent construction by removal operations.

END OF SECTION

A 4/18/90

SECTION 04455

MARBLE - EXTERIOR

PART 1 - GENERAL

1.01 SUMMARY

A. This Section specifies requirements for exterior marble veneer with mortar or sealant joints and marble paving.

B. Furnish inserts, reglets and other embedded items in concrete or masonry for installation under other Sections of the Specifications.

1.02 REFERENCES

The following is a listing of the publications referenced in this Section:

American Society for Testing and Materials (ASTM)

ASTM A 153 - Zinc Coating (Hot-Dip) on Iron and Steel Hardware.

ASTM A 167 - Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet and Strip.

ASTM A 276 - Stainless and Heat-Resisting Steel Bars and Shapes.

ASTM A 307 - Carbon Steel Externally Threaded Standard Fasteners.

ASTM C 91 - Masonry Cement

ASTM C 144 - Aggregate for Masonry Mortar

ASTM C 150 - Portland Cement

ASTM C 207 - Hydrated Lime for Masonry Purposes

ASTM C 270 - Mortar for Unit Masonry

ASTM C 503 - Marble Building Stone (Exterior)

Marble Institute of America (MIA)

Dimensional Stone - Design Manual III

1.03 ENVIRONMENTAL REQUIREMENTS

A. Cold Weather Protection

1. Remove ice or snow formed on stonework bed by carefully applying heat until top surface is dry to touch.

2. When mortar joints or marble paving is shown on the Contract Drawings, perform the following construction procedures while Work is progressing:

a. When air temperature is between 40 degrees F and 32 degrees F, heat sand or mixing water to produce mortar temperatures between 40 degrees F and 120 degrees F.

b. When air temperature is between 32 degrees F and 25 degrees F, heat sand or mixing water to produce mortar temperatures between 40 degrees F and 120 degrees F; maintain temperature of mortar on boards above freezing.

c. When air temperature is between 25 degrees F and 20 degrees F, heat sand and mixing water to produce mortar temperatures between 40 degrees F and 120 degrees F; maintain temperature of mortar on boards above freezing; use other heat sources on surfaces under construction; use wind breaks when wind is in excess of 15 mph.

d. When air temperature is 20 degrees F or below, heat sand and mixing water to produce mortar temperatures between 40 degrees F and 120 degrees F; provide enclosures and auxiliary heat to maintain air temperature above 32 degrees F; use other heat sources on concealed portions of construction.

3. Protect completed stonework and partially completed stonework as follows by maintaining stonework temperatures above 32 degrees F for 20 hours, minimum and

a. When the mean daily air temperature is between 40 degrees F and 33 degrees F, protect stonework from rain or snow for at least 24 hours after installation by covering with weather-resistive membrane. When the mean daily air temperature is between 32 degrees F and 25 degrees F, completely cover stonework with weather-resistive membrane for at least 24 hours after installation.

b. When the mean daily air temperature is between 25 degrees F and 20 degrees F, completely cover stonework with insulating blankets or similar protection for at least 24 hours after installation. When the mean daily air temperature is 20 degrees F or below, maintain stonework temperature above 32 degrees F for 24 hours after installation using enclosures and supplementary heat, electric heating blankets, infrared lamps, or other methods acceptable to the Engineer.

5. Do not use frozen materials or materials mixed or coated with ice or frost. Do not use salt to thaw ice in anchor holes or slots. When using mortor or grout do not lower the freezing point by use of admixtures or anti-freeze agents, and do not use calcium chloride.

B. During all seasons, protect partially completed stonework against weather when Work is not in progress. Cover with strong waterproof, non-staining membrane.

1.04 QUALITY ASSURANCE

A. Source Quality Control

1. Provide stone which complies with recommendations of Marble Institute of America (MIA) "Dimensional Stone-Design Manual III" and ASTM C 503.

2. Obtain stone, from quarry, with consistent color range and texture throughout the Work.

B. The entity performing fabrication of stone shall be a firm which has successfully fabricated stone similar to the quality specified in this Section, for a period of not less than 5 years and is equipped to provide the quantity shown on the Contract Drawings, without delaying the progress of the Work.

C. Installer Qualifications

The entity performing stonework and stone fitting shall have successfully completed within the past 3 years, at least 3 stone installations similar in scope to those required under this Contract. Said entity shall assign at least one mechanic employed on the previous installation to the Work of this Contract.

D. Job Mock-Up

Prior to installation of stonework, provide 6 feet x 4 feet sample panels of stonework shoving range of color, texture and workmanship proposed for the completed Work. Build mock-up at the Site, as directed by the Engineer, using stone, anchors and jointing, as shown on the Contract Drawings and as detailed on approved shop drawings. Workers erecting mock-up shall be the same as those performing the Work.

1. Obtain the Engineer's acceptance of visual qualities of sample panels before start of stonework. Replace unsatisfactory mock-up Work, as directed, until acceptable to the Engineer. Retain sample panels during construction as a standard for judging completed stonework. Do not alter, move or destroy mock-up until directed by the Engineer. When directed, remove from Authority property.

2. Where sealant primers and sealant joints are shown on the Contract Drawings for the finished stonework, build mock-up and apply compounds in sufficient time to allow for final test for staining from such applications.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Protect stone during shipping, storage and construction against moisture, soiling, staining and physical damage.

B. Handle stone to prevent chipping, breakage, soiling or other damage. Do not use pinch or wrecking bars without protecting edges of stone with wood or other rigid materials. Lift with wide-belt type slings wherever possible; do not use wire rope or ropes containing tar or other substances which might cause staining. If required, use wood rollers and provide a cushion at the end of wood slides.

C. Store stone on wood skids or pallets. Place and stack skids and stones to distribute weight evenly and to prevent breakage or cracking of stones. Protect stored stone from weather with waterproof, non-staining covers or enclosures, but allow air to circulate around the stones.

D. Protect mortar materials, if used, and stonework accessories from weather, moisture and contamination with soil or other foreign materials.

1.06 SUBMITTALS

A. Submit the following in accordance with the requirements of "Shop Drawings, Catalog Cuts, and Samples" of Division 1 - GENERAL PROVISIONS:

1. Product Data

Submit the supplier specifications for each type of stonework to be provided, including the supplier's certification that each type complies with the requirements specified in this Section. Include instructions for handling, storage, installation and protection of each type.

2. Samples

Submit two sets of samples not less than 12 inches x 12 inches in size of each different color, grade and finish of stonework to be provided and colored painting mortar to be used, if any. Include in each set full range of exposed color and texture proposed for completed Work.

3. Shop Drawings

Submit cutting and setting drawings showing sizes, dimensions, sections and profiles of stonework units; arrangement and provisions for jointing; provisions for anchoring, fastening, supports and necessary details for lifting devices and reception of other Work. Indicate location of each stonework unit on setting drawings with number designation corresponding to number marked on each unit.

a. Show location of inserts (for stone anchors and supports) which are built into concrete or masonry.

b. Where decorative surfaces or inscriptions are shown on the Contract Drawings, provide large scale details of such decorations or inscriptions.

B. Submit fabricator's and installer's qualifications to the Engineer in accordance with 1.04 B and 1.04 C of this Section.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Marble

1. Furnish marble in size, thickness, color and finish shown on the Contract Drawings for each area of use. Comply with requirements of 1.04 A of this Section.

2. Match Engineer's samples, where required by the Contract Drawings.

3. Matching Units

Where shown on the Contract Drawings to "match existing", furnish marble units of matching color, finish, size and profile.

B. Mortar and Grout

1. Cement

Provide white cement as follows:

a. Portland Cement

ASTM C 150, but in compliance with the staining requirements of ASTM C 91 for not more than 0.03% water soluble alkali. Furnish Type I except that Type III may be used for setting stonework in cold weather.

b. Masonry cement shall be ASTM C 91, non-staining.

2. Hydrated lime shall be ASTM C 207, Type S.

3. Sand

ASTM C 144, except graded with 100 percent passing the No. 16 sieve for 1/4 inch and narrower joints.

a. For white pointing mortar, furnish natural white sand or ground white stone meeting the requirements of this Section.

4. For colored mortar, if shown on the Contract Drawings, provide natural and synthetic iron oxides and chromium oxides, compounded for use in mortar mixes. Subject to compliance with the requirements of this Section, provide products of the following to produce color shown on the Contract Drawings, or if not shown, as selected by the Engineer from samples submitted in accordance with 1.06 A.2 of this Section.

   a. Solomon Grind-Chem Services, Inc. Springfield, IL; "SGS Mortar Colors"

   b. Sonborn · B.P. Division of Rexnord Chemicals, Inc., Minneapolis, MN; "Sonobrite"

   c. Davis Colors Subsidiary of Rockwood Industries, Los Angeles, CA; "True Tone Mortar Colors"

5. Use water that is clean and potable.

C. Stonework Accessories

1. Adjustable Inserts

   Malleable iron of type and size shown on the Contract Drawings.

2. Expansion Anchors

   Type, size, and load capacity shown on the Contract Drawings.

   a. For anchoring into concrete, fabricate from hot-dipped galvanized steel.

   b. For anchoring into stone, fabricate from Type 302/304 stainless steel as per ASTM A 276.

3. Anchor Bolts, Nuts and Washers

   Fabricate from Type 302/304 stainless steel as per ASTM A 276 if in contact with stone; otherwise, provide regular low carbon steel bolts and nuts (ASTM A 307) hot-dip galvanized, complying with ASTM A 153.

4. Stone Anchors

   Type and size shown on the Contract Drawings or, if not shown, fabricate anchors and dowels from Type 302/304 stainless steel as per ASTM A 276.

5. Setting Buttons

Lead or plastic buttons of the thickness required for the joint size shown on the Contract Drawings and of the size required to maintain uniform joint width.

6. Stonework Flashing

Furnish concealed flashing, where shown on the Contract Drawings to be built into stonework, of Type 302/304 stainless steel per ASTM A 167, 2 D finish, fully annealed or dead-soft temper, 0.012 inch thick,unless otherwise shown on the Contract Drawings.

7. Dovetail Slots

If shown on the Contract Drawings, fabricate from not less than 24 gage galvanized steel, unless otherwise shown on the Contract Drawings. Provide with removable filler strips.

8. Weeps

1/4 inch inside diameter polyethylene tubing, where sealant joints are shown on the Contract Drawings; rectangular plastic tube 1-1/2 inches x 3-1/2 inches x 3/8 inch outside width and spaced as shown on the Contract Drawings, and as manufactured by Hohmann and Barnard, Inc., or approved equal, where mortar joints are shown on the Contract Drawings.

D. Mortar Mix

Non-staining, cement/lime mortar, complying with ASTM C 270, Proportion Specification and using materials specified therein.

1. Use Type S unless otherwise shown on the Contract Drawings.

2. Use mortar for grouting as shown on the Contract Drawings.

2.02 FABRICATION

A. General

Fabricate as shown on the Contract Drawings and as detailed on approved shop drawings and in compliance with recommendations of the applicable stone association specified in this Section. Provide holes and sinkages cut or drilled for anchors, fasteners, supports and lifting devices, as shown on the Contract Drawings and as necessary to secure stonework in place. Cut and back-check as required for proper fit and clearance. Shape beds to fit supports.

B. Matching Areas of Wall Paneling

Fabricate from one block or contiguous blocks, where shown on the Contract Drawings as a continuous area of sequence matched veining.

1. Bookmatch stonework of single course in height and diamond match if more than one course in height, unless otherwise shown on the Contract Drawings.

C. Contiguous Work

Provide chases, reveals, reglets, openings and similar spaces and features as required for contiguous Work. Coordinate with the Contract Drawings and approved shop drawings showing contiguous Work.

D. Cut accurately to shape and dimensions shown on approved shop drawings, maintaining fabrication tolerances of the applicable stone association specified in this Section.

1. Dress joints (bed and vertical) straight and at 90 degree angle to face, unless otherwise shown on the Contract Drawings.

2. Provide quirk-mitered corners, unless otherwise shown on the Contract Drawings. Provide for cramp anchorage in top and bottom bed joints of corner units, unless otherwise shown on the Contract Drawings.

3. Joint Width

Cut to provide joint widths as shown on the Contract Drawings or, if not shown, cut to allow for uniform 1/4 inch wide joints.

E. Thickness

Provide stone of thickness shown on the Contract Drawings. Saw-cut back surfaces which will be concealed in finished Work.

1. Allow not less than 1 inch clearance between back face of units and structure framing (or fireproofing, if any).

F. Fabricate molded Work to profiles shown on the Contract Drawings, with arrises sharp and true and matched at joints between units.

G. Cut flashing reglets, 5/8 inch wide x 3/4 inch deep, unless otherwise shown on the Contract Drawings.

H. Cut gasket reglets in edges of panels where gasketed joints are shown on the Contract Drawings. Coordinate with profile of gaskets to be used in the Work.

I. Fabricate saddles and thresholds, if shown on the Contract Drawings, to profiles and dimensions shown.

J. Carve and cut decorative surfaces and inscriptions, if shown on the Contract Drawings, in accordance with approved shop drawings.

PART 3 - EXECUTION

3.01 PREPARATION

A. Coordinate the placement of inserts and flashing reglets which are to be used by stone mason for anchoring, supporting and flashing stonework. Furnish installers of other Work with specific requirements and drawings or templates showing location of inserts for stone anchors and supports.

B. Clean stone before setting by thoroughly scrubbing with fiber brushes followed by a thorough drenching with clear water. Use only mild cleaning compounds that contain no caustic or harsh fillers or abrasives. If not thoroughly wet at time of setting, drench or sponge stone. Do not wet expansion or control joint surfaces.

3.02 INSTALLATION

A. Contiguous Work

Provide chases, reveals, reglets, openings and other spaces as shown on the Contract Drawings or required for contiguous Work. Close-up opening in stonework after other Work is in place. Use materials and set to match surrounding stonework.

B. Ferrous Metal

Where stonework will contact ferrous metal surfaces which will be concealed in back-up construction (anchors, supports, structural framing and similar surfaces), apply a heavy coat of bituminous paint on metal surfaces prior to setting of stone. Do not extend coating onto portions of ferrous metal which will be exposed in finished Work. Do not apply coating to stainless or non-ferrous metals.

C. Provide expansion joints where shown on the Contract Drawings. Do not fill with mortar. Install continuous strips of preformed joint filler to allow for installation of backer rod and sealant or compressed seal, as shown on the Contract Drawings, and as specified in Division 7 of these specifications.

D. Set stone in accordance with the Contract Drawings and approved shop drawings for stonework. Provide anchors, supports, fasteners and other attachments shown on the Contract Drawings or necessary to secure stonework in place. Shim and adjust accessories for proper setting of stone. Completely fill holes, slots and other sinkages for anchors, dowels, fasteners and supports with mortar during setting of stones.

E. Allowable Tolerance

1. Variation from Plumb

For lines and surfaces of columns, walls and arrises, do not exceed 1/4 inch in 10 feet, 3/8 inch in story height or 20 feet maximum, nor 1/2 inch in 40 feet or more. For external corners, expansion joints and other conspicuous lines, do not exceed 1/4 inch in any story or 20 feet maximum, nor 1/2 inch in 40 feet or more.

2. Variation from Level

For grades shown on the Contract Drawings for exposed lintels, sills, parapets, horizontal grooves and other conspicuous lines, do not exceed 1/4 inch in any bay or 20 feet maximum, nor 3/4 inch in 40 feet or more.

3. Variation of Linear Building Line

For any position shown on the floor plans of the Contract Drawings and any related portion of columns, walls and partitions, do not exceed 1/2 inch in any bay or 20 feet maximum, nor 3/4 inch in 40 feet or more.

4. Variation in Cross-Sectional Dimensions

For columns and thickness of walls from dimensions shown on the Contract Drawings, do not exceed minus 1/4 inch, nor plus 1/2 inch.

F. Walls

Erect walls plumb and true with joints uniform in width and accurately aligned. Set in full bed of mortar, unless otherwise shown on the Contract Drawings. Provide setting buttons as required to prevent extrusion of mortar. Do not set units above until mortar in courses below is set sufficiently to maintain alignment and prevent extrusion.

G. Cavity Construction

Where open space between back of stone units and back-up or framing is shown on the Contract Drawings, keep cavity open; do not fill with mortar or grout. Provide plastic weep holes where shown on the Contract Drawings.

1. Back-paint stone wall units with non-staining, asphalt emulsion dampproofing or cement-base masonry dampproofing compound. Wherever possible, apply compound to back of stone units and joints after setting.

H. Where joints are shown on the Contract Drawings to be set on shims without mortar, provide quantity of shims required to maintain uniform joint width and alignment of stone units. Sealing of joints is specified under Division 7 of these Specifications.

I. Stone Paving

1. Set on concrete subbase that has a rough broomed finish. Clean subbase to remove dirt, dust, debris and loose particles. Saturate concrete subbase with clean water several hours before placing setting bed. About one hour prior to placing setting bed, remove surface water.

2. Apply slush coat of cement grout over surface of concrete subbase about 15 minutes prior to placing setting bed. Limit area of slush coat to avoid drying out prior to placement of setting bed and apply by trowel or brush. Do not exceed 1/16 inch thickness for cement slush coat.

3. Setting bed

   Mix one 94 lb. bag of cement to 3 cu. ft. of sand (measured in a damp, loose condition). Use only enough water to produce a moist surface when setting bed is ready for setting of stone. Spread and screed to a uniform 1 inch minimum thickness, except for minor variations required to produce a true surface, level in plane or uniformly sloped for drainage as shown. Mix and place only the amount which can be covered with stone prior to initial set of bed. Cut back, level edge, remove and discard setting bed material which was initially set prior to placing stone.

4. Wet stone thoroughly before setting.

5. Set stone before initial set of cement bed occurs. Do not set stone on dry bed. Apply a thin layer of neat cement past 1/32 inch to 1/16 inch thick by brushing or troweling over setting bed, or apply 1/32 inch thick cement coating to bottom of stone. Tamp and beat stone for complete contact between stone and setting bed. Set and level each unit immediately. Do not set large areas and later level. Set stone in pattern shown on the Contract Drawings with uniform joints of the width shown or, if not shown, provide joints not more than 1/4 inch wide.

6. Grout joints as soon as possible after initial set of setting bed. Force grout into joints, strike flush and tool slightly concave. Wet joint surfaces, if dry, prior to grouting.

   a. Use portland cement mixed in the proportion of one bag of portland cement to 2 cu. ft. of sand (measured in a damp, loose condition) mixed with water to the consistency of heavy cream.

7. Cure grout by maintaining in a moist condition for 7 days.

8. Remove grout spillage from face of stone as Work progresses.

9. Do not permit traffic on horizontal stone surfaces during setting of units or for at least 24 hours after final grouting of joints.

3.03 ADJUSTMENTS

A. Remove and replace stone units which are broken, chipped, stained or otherwise damaged. Where directed, remove and replace units which do not match adjoining stonework. Provide new matching units, install as specified in this Section and point-up joints to eliminate evidence of replacement. Repoint defective and unsatisfactory joints as required to provide a neat, uniform appearance.

B. Clean stonework not less than 6 days after completion of Work, using clean water and stiff-bristle brushes. Do not use wire brushes, acid-type cleaning agents or other cleaning compounds with caustic or harsh fillers.

C. Provide final protection and maintain conditions, in a manner acceptable to the Engineer, which ensures stonework being without damage, discolorations, or deterioration during subsequent construction and until time of issuance of the Certificate of Final Completion.

END OF SECTION

A

SECTION 05580

SHEET METAL FABRICATIONS

PART 1 - GENERAL

1.01 SUMMARY

This Section specifies requirements for sheet metal fabrications.

1.02 REFERENCES

The following is a listing of the publications referenced in this Section:

American Architectural Manufacturers Association (AAMA)

AAMA 605.2	High Performance Organic Coatings on Architectural Extrusions and Panels.
AAMA 606.1	Inspection Methods for Integral Color Anodic Finishes for Architectural Aluminum.
AAMA 607.1	Inspection Methods for Clear Anodic Finishes for Architectural Aluminum.
AAMA 608.1	Inspection Methods for Electrolytically Deposited Color Anodic Finishes for Architectural Aluminum.

American Society for Testing and Materials (ASTM)

ASTM A 167	Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet and Strip.
ASTM A 366	Steel, Sheet, Carbon, Cold-Rolled, Commercial Quality.
ASTM A 526	Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process, Commercial Quality.
ASTM A 527	Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process, Lock-Forming Quality.
ASTM A 591	Steel Sheet, Cold-Rolled, Electrolytic Zinc-Coated.

ASTM A 780	Practice for Repair of Damaged Hot-Dip Galvanized Coatings.
ASTM B 209	Aluminum and Aluminum-Alloy Sheet and Plate.
ASTM C 665	Mineral Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing.
ASTM D 1056	Flexible Cellular Materials - Sponge or Expanded Rubber.
ASTM E 136	Test Method for Behavior of Materials in a Vertical Tube Furnace at 750 deg. C.

American Welding Society (AWS)

AWS D 1.1	Structural Welding Code, Steel
AWS D 1.2	Structural Welding Code, Aluminum

National Association of Architectural Metal Manufacturers (NAAMM)

Metal Finishes Manual for Architectural and Metal Products.

Steel Structures Painting Council (SSPC)

SSPC PA 1	Paint Application Specification No. 1 - Shop, Field and Maintenance Painting.
SSPC Paint 12	Paint Specification No. 12 - Cold Applied Asphalt Mastic (Extra Thin Film).
SSPC Paint 20	Paint Specification No. 20 - Zinc-Rich Primers (Type I, "Inorganic" and Type II, "Organic").
SSPC SP1	Surface Preparation Specification No. 1 Solvent Cleaning.
SSPC SP5	Surface Preparation Specification No. 5 White Metal Blast Cleaning.
SSPC SP8	Surface Preparation Specification No. 8 Pickling.

1.03 ENVIRONMENTAL REQUIREMENTS

Verify size, location, and placement of sheet metal fabrications with adjoining construction prior to fabrication.

1.04 QUALITY ASSURANCE

A. Manufacturer Qualifications

Firm which employs skilled persons and which has successfully fabricated products similar to those required for Work of this Section and which has sufficient capacity to produce required units without causing delay in the Work.

B. Single Source Responsibility

Obtain sheet metal fabrications from a single manufacturer.

C. Engineer Qualifications

Professional engineer licensed to practice in state where the project is located and experienced in providing engineering services for the successful installation of sheet metal fabrications similar in material, design and extent to that indicated in these Specifications and shown on the Contract Drawings for Work of this Section.

D. Coordinate fabrication and installation of items specified in this Section with other adjoining units of Work.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Deliver sheet metal fabrications as factory assembled units conforming to 2.03 D and 2.03 E of this Section, with protective crating and covering.

B. Store products on elevated platforms in a dry location.

1.06 SUBMITTALS

A. Submit the following in accordance with the requirements of "Shop Drawings, Catalog Cuts, and Samples" of Division 1 - GENERAL PROVISIONS:

1. Product data for each type of product specified in this Section where shown on the Contract Drawings.

2. Shop drawings for sheet metal fabrications, including plans, elevations and detail sections. Indicate jointing, fasteners, anchorage, and accessory items and specify finishes.

a. Where installed products are indicated in these Specifications and/or this Section or shown on the Contract Drawings to comply with certain design loadings, include structural computations, material properties, and other information needed for structural analysis which have been prepared by, or under the supervision of, a qualified professional engineer license in the state in which the Work is to be performed. All material shall be signed and sealed with a professional seal for the State in which the Work is to be performed.

3. Coordination drawings for sheet metal fabrications housing items specified under other Sections of these Specifications.

4. Samples for verification purposes in 8 inch square units of each metal finish shown on the Contract Drawings, prepared on metal of same composition and thickness to be used in final construction.

   a. For color anodized aluminum, provide sets for each color, texture, and pattern shown on the Contract Drawings showing full range of variations expected in these characteristics.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

Subject to compliance with the requirements of this Section, provide products by one of the following or approved equal:

American Steel Products Corp., Farmingdale, NY
Brandt-Airflex Corp., Farmingdale, NY
Custom Enclosures, Inc., Rosemont, IL
Superior Fireproof Door Inc., Scranton, PA

2.02 MATERIALS

A. General

Provide sheet metals selected for their surface flatness, smoothness and freedom from surface blemishes where exposed to view in the finished unit. Do not use materials whose exposed surfaces exhibit pitting, seam marks, roller marks, variations in flatness exceeding those permitted by referenced standards for stretcher-leveled metal sheet, stains, discoloration or other imperfections.

B. Steel

As follows, where shown on the Contract Drawings:

1. Galvanized Steel Sheet

ASTM A 526 commercial quality, or ASTM A 527 lockforming quality. Coating Designation G 90, mill phosphatized, stretcher leveled.

2. Steel Sheet

Commercial quality cold-rolled carbon steel sheet, stretcher leveled, electrolytic zinc-coated unless otherwise shown on the Contract Drawings or specified in this Section to be uncoated complying with the following requirements, as applicable:

a. Electrolytic Zinc-Coated Steel Sheet

ASTM A 591, with Class C zinc coating; chemically treated in mill with phosphate solution and light chromate rinse.

b. Uncoated Steel Sheet

ASTM A 366, exposed, matte finish.

3. Stainless Steel Sheet

ASTM A 167, Type 302 or 304, stretcher leveled, with the following finishes in accordance with NAAMM "Metal Finishes Manual for Architectural and Metal Products" as shown on the Contract Drawings:

a. Cold-rolled for surfaces requiring extensive polishing after fabrication to produce an AISI No. 6, 7 or 8 finish.

b. Polished for surfaces requiring little or no polishing after fabrication to produce an AISI No. 2B or 4 finish.

C. Aluminum Sheet (where shown on the Contract Drawings)

Alloy and temper recommended by manufacturer for use intended and as suitable for application of finish shown on the Contract Drawings, but with not less than the strength and durability properties specified in ASTM B 209 for 5005-H15.

D. Miscellaneous Materials

Where shown on the Contract Drawings and as follows:

1. Sound Deadening Insulation

Unfaced mineral fiber blanket or batt insulation complying with ASTM C 665 for Type I, and passing ASTM E 136 test.

2. Welding Electrodes and Filler Metal

Type and alloy of filler metal and electrodes as recommended by producer of metal to be welded, complying with applicable AWS D1.1 or D1.2 requirements and as required for strength and compatibility in the fabricated items.

a. Use filler metals and welding procedures which will blend with and match the color of sheet metal being joined and will avoid discoloration at welds.

3. Fasteners

Of same basic metal and alloy as fastened metal, unless otherwise shown on the Contract Drawings. Do not use metals which are corrosive or incompatible with metals joined.

a. Provide concealed fasteners for interconnection of sheet metal fabrications and for their attachment to other Work except where exposed fasteners are unavoidable or are the manufacturer's standard fastening method.

b. Provide Phillips flat-head screws for exposed fasteners, unless otherwise shown on the Contract Drawings.

4. Anchors and Inserts

Of type, size, and material required for type of loading and installation shown on the Contract Drawings, or as recommended by manufacturer, unless otherwise shown on the Contract Drawings. Use nonferrous metal or hot-dip galvanized anchors and inserts for exterior installations and elsewhere as required for corrosion resistance.

5. Flexible Cellular Neoprene Gaskets

ASTM D 1056, Type 1, Class A, Grade as recommended by gasket manufacturer to obtain airtight seal for application indicated in this Section and/or shown on the Contract Drawings.

6. Bituminous Paint

Cold-applied asphalt mastic complying with SSPC Paint 12 containing no asbestos fibers.

7. Joint sealers for concealed joints shall be a butyl-polyisobutylene sealant.

2.03 FABRICATION

A. General

Fabricate sheet metal fabrications to comply with the Contract Drawings for design, dimensions, materials, joinery, and performance.

B. Coordinate dimensions and attachment methods of sheet metal fabrications with those of adjoining products and construction to produce integrated assemblies with closely fitting joints, and edges and surfaces aligned with one another location of fabrications in reference to adjoining construction shall be as shown on the Contract Drawings.

C. Increase metal thickness or reinforce metal with concealed stiffeners and/or backing materials as required to produce surfaces whose variations in flatness exceed those permitted by referenced standards for stretcher-leveled metal sheet and to impart sufficient strength for use shown on the Contract Drawings.

1. Where shown on the Contract Drawings, fill space between stiffeners with sound deadening insulation permanently attached to face sheet.

D. Preassemble sheet metal fabrications in the shop to the greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Clearly match mark units for reassembly and coordinated installation.

E. Form sheet metal fabrications in maximum practical length to minimize joints and without exposed cut edges. Fold back exposed ends of unsupported sheet metal to form a 1/2 inch wide hem on the concealed side, or ease exposed edges with backing to a radius of approximately 1/32 inch. Produce flat, flush surfaces without cracking and grain separation at bends.

F. Continuously weld all joints and seams in accordance with 2.02 D.2 of this Section, except where other methods of joining are shown on the Contract Drawings; grind, fill, and dress welds to produce smooth flush exposed surfaces in which welds are invisible after final finishing is completed.

G. Build-in straps, plates and brackets as required for support and anchorage of fabricated items to adjoining construction; reinforce sheet metal units as required for attachment and support of other construction.

H. Closures and Trim

Where shown on the Contract Drawings and as follows:

1. Form closures and trim members from sheet metal of type and minimum nominal thickness as indicated below, unless otherwise shown on the Contract Drawings. Incorporate components required for support and installation of closures and trim. Fabricate closures and trim to tightly close with adjoining construction.

   a. Metal for Interior Installations: Steel sheet, 0.0478 inch (18 gage).

   b. Metal for Exterior Installations: Galvanized steel sheet, 0.0516 inch (18 gage), with weathertight joints at exterior installations.

2. Fasteners shall conform to 2.02 D.3 of this Section, located where they will be as inconspicuous as possible. Size fasteners to support closures and trim, with fasteners spaced to prevent buckling or waviness in finished surfaces.

3. Drill and tap holes required for securing closures and trim to other surfaces.

4. Incorporate gaskets where shown on the Contract Drawings or required for concealed, continuous seal at abutting surfaces.

5. Support joints with concealed stiffeners as required to hold exposed faces of adjoining sheets in flush alignment.

6. Miter or cope trim members at corners to form tight joint.

I. Window Stools (where shown on the Contract Drawings)

Form window stools from sheet metal of type and minimum nominal thickness including end closures as indicated below.

1. Galvanized steel sheet, 0.0516 inch (18 gage), with weathertight joints at exterior installations.

2. Aluminum sheet, 0.0625 inch.

3. Stainless steel sheet, 0.0500 inch (16 gage).

J. Blind and Drapery Pockets (where shown on the Contract Drawings)

1. Form pockets from sheet metal of type and minimum nominal thickness as indicated below, including end closures. Coordinate dimensions and attachment methods with blind and drapery equipment, window frames, ceiling suspension system, and other related construction to produce a coordinated, closely fitting assembly.

   a. Steel sheet, 0.0478 inch (18 gage).

   b. Galvanized steel sheet, 0.0516 inch (18 gage).

2. Reinforce pocket for attachment of window treatment equipment and hardware or increase metal thickness.

3. Divide continuous pockets by means of built-in partitions located to separate adjoining drapery and blind units, to coincide with window mullions, and to receive filler panels at ends of partitions.

K. Filler Panels (where shown on the Contract Drawings)

1. Form filler panels for closing ends of partition systems from sheet metal of type and minimum nominal thickness indicated below, and at other locations as shown on the Contract Drawings. Incorporate reveals, trim, and concealed anchorages for attachment to adjacent surfaces.

   a. Steel sheet, 0.0598 inch (16 gage).

   b. Galvanized steel sheet, 0.0635 inch (16 gage).

2. Attach gaskets to all edges of panels which abut adjacent surfaces to form a continuous seal. Use compressible gaskets of mastic sealing tape, applied to center of panel edges to be concealed from view, unless otherwise shown on the Contract Drawings.

3. Fill interior of panel with sound deadening insulation permanently attached to inside panel faces where shown on the Contract Drawings.

L. Lighting Troughs (where shown on the Contract Drawings)

1. Form lighting troughs from sheet metal of type and minimum nominal thickness as indicated below. Coordinate size of troughs, location of cutouts for electrical wiring, and method of attachment to adjoining construction.

   a. Steel sheet, 0.0478 inch (18 gage).

   b. Galvanized steel sheet, 0.0516 inch (18 gage).

M. Heating-Cooling Unit Enclosures (where shown on the Contract Drawings)

1. Fabricate heating-cooling unit enclosures from galvanized steel sheet of minimum nominal thickness as indicated below, and conform to requirements of 2.03 M.2 of this Section, unless otherwise shown on the Contract Drawings.

   a. Steel sheet

      1. Framing: 0.1046 inch (12 gage).

      2. Sills and Stools: 0.0747 inch (14 gage).

      3. Front Panels and Bases: 0.0598 inch (16 gage).

      4. Concealed Panels and Trim: 0.0359 inch (20 gage).

   b. Galvanized steel sheet

      1. Framing: 0.1084 inch (12 gage).

      2. Sills and Stools: 0.0785 inch (14 gage).

      3. Front Panels and Bases: 0.0635 inch (16 gage).

      4. Concealed Panels and Trim: 0.0396 inch (20 gage).

2. Structural Performance

   Design, and fabricate enclosures so that, when installed, they shall be capable of withstanding 200 lbf per sq. foot or 150 lbf per linear foot, whichever produces the greatest stress without exceeding the allowable design working stress of materials, including anchors and connections, or of exhibiting permanent deformation in any of the components making up enclosures.

3. Incorporate stiffeners or laminated backing using noncombustible materials as required for strength and rigidity. Include brackets, plates and straps in assemblies for support of other Work.

4. Provide louvers and grilles of size, type, and materials shown on the Contract Drawings.

   a. For removable grilles use modular units with recessed openings and enclosures formed into surfaces of enclosures, without use of blank filler panels between grilles, so that face panels and stools are continuous. Fabricate removable grilles and openings to close tolerances to produce well-fitted assemblies free of warp or rattle with grilles supported continuously along parallel edges and tops flush with top of enclosure.

   b. Form grille supports to serve also as collars for connection to discharge opening in heating-cooling units where shown on the Contract Drawings, or required for operation.

5. Incorporate removable tops and fronts where shown on the Contract Drawings, or required for access to heating-cooling units and to piping, ductwork, controls, and electrical service, with panels and the openings fabricated as follows:

   a. Fit with a tolerance of not less than 1/32 inch and not more than 1/10 inch at each edge, with face of panels flush with adjoining fixed surfaces of enclosure.

   b. To enable easy removal of panels without interfering with adjoining construction or furniture hold panels in place with concealed clips and hardware which prevent warp or rattle.

6. Incorporate hinged access panels in enclosures for access to heating-cooling unit controls, either as separate elements or integrated with grille openings, as shown on the Contract Drawings.

7. Coordinate construction, configuration and dimensions of enclosures with those of heating-cooling units. Provide blind knock-outs for piping, ductwork, control lines, and electrical conduit and wiring, and, where shown on the Contract Drawings or required, provide support for those elements and heating-cooling units.

8. Locate fixed surfaces of enclosure to coincide precisely with window mullions and partition system terminations. Provide closures at ends of units, at recessed openings in base of units and other locations where required to conceal from view unfinished wall or floor surfaces, piping, conduit, ductwork or heating-cooling units.

   a. Where shown on the Contract Drawings, provide built-in partitions (bulkheads) within enclosures between heating-cooling units, located to coincide with mullions and partition system terminations. Fabricate panels in manner similar to exposed filler panels to prevent transmission of sound.

9. Provide sound-deadening for concealed faces of metal panels over 6 inches wide, consisting of SSPC Paint 12 coating applied at the minimum rate of 20 sq. ft. per gal. Apply coating after completion of shop finishing.

N. Fascia Panels (where shown on the Contract Drawings)

1. Form fascia panels from aluminum sheet metal of 0.040 inch minimum nominal thickness, unless otherwise shown on the Contract Drawings.

2. Structural Performance

   Design, and fabricate fascia panels so that, when installed, they are capable of withstanding wind pressure of not less than 30 psf inward and 30 psf outward without exceeding the allowable design working stress of materials, including anchors and connections, or of exhibiting permanent deformation in any of components making up fascias.

3. Fabricate and install fascia panels systems which allow no uncontrolled water penetration.

4. Incorporate stiffeners or laminated backing using noncombustible materials as required for strength and rigidity.

5. Fasteners shall conform to 2.02 D.3 of this Section, located where they will be as inconspicuous as possible, sized to support fascia panels, with fasteners spaced to prevent buckling or waviness in finished surfaces.

6. Drill and tap holes required for securing fascia panels to other surfaces.

7. Miter or cope fascia panels at corners to form tight joints.

8. Refer to Division 7 Section of this Specifications on sealants, where perimeter sealant is shown on the Contract Drawings or where required to maintain watertightness of fascia panel system.

O. Soffit Panels (where shown on the Contract Drawings)

1. Form soffit panels from aluminum sheet metal of 0.040 inch minimum nominal thickness, unless otherwise shown on the Contract Drawings.

2. Structural Performance

Design, and fabricate soffit panels so that, when installed, they are capable of withstanding wind pressure of not less than 37.5 psf inward and 37.5 psf outward without exceeding the allowable design working stress of materials, including anchors and connections, or of exhibiting permanent deformation in any of the components making up the soffits.

3. Fabricate and install soffit panels systems which allow no uncontrolled water penetration.

4. Incorporate stiffeners or laminated backing using noncombustible materials as required for strength and rigidity.

5. Fasteners shall conform to 2.02 D.3 of this Section, located where they will be as inconspicuous as possible, sized to support soffit panels, with fasteners spaced to prevent buckling or waviness in finished surfaces.

6. Drill and tap holes required for securing soffit panels to other surfaces.

7. Miter or cope soffit panels at corners to form tight joints.

8. Refer to Division 7 Section of these Specifications on sealants where perimeter sealant is shown on the Contract Drawings or where required to maintain watertightness of soffit panel system.

2.04 SHOP PAINTING

A. Finishes

1. Comply with NAAMM "Metal Finishes Manual for Architectural and Metal Products" for recommendations relative to application and designations of stainless steel and aluminum finishes.

a. Complete mechanical finishes of flat sheet metal surfaces before fabrication, wherever possible. After fabrication, finish all joints, bends, abrasions, and other surface blemishes to match sheet finish.

b. Apply organic and anodic finishes to sheet metal fabrications after assembly.

2. Comply with SSPC PA 1 for steel paint sheet finishes.

3. Protect finishes on exposed surfaces from damage by application of adhesive paper or other temporary protective covering, prior to shipment.

B. Aluminum Finishes

Where shown on the Contract Drawings and as follows:

1. Finish designations prefixed by "AA" conforming to the system established by the Aluminum Association for designating aluminum finishes, listed in NAAMM "Metal Finishes Manual for Architectural and Metal Products".

2. Class II clear anodized finish at interior locations

AA-M12C22A31 (Mechanical finish: as fabricated, nonspecular; Chemical finish: etched, medium matte; Anodic coating: Class II architectural, clear film thicker than 0.4 mil).

3. Class I Clear Anodized Finish at exterior locations

AA-MI2C22A41 (Mechanical finish: as fabricated, nonspecular; Chemical finish: etched, medium matte; Anodic coating: Class I architectural, clear film thicker than 0.7 mil) complying with AAMA 607.1.

4. Class I Color Anodized Finish

AA-M12C22A42/A44 (Mechanical finish: as fabricated, nonspecular; Chemical finish: etched, medium matte; Anodic coating: Class II Architectural, film thicker than 0.7 mil with integral color or electrolytically deposited color) complying with AAMA 606.1 or AAMA 608.1, of color as shown on the Contract Drawings.

5. Baked Enamel Finish

AA-C12C42R1x (Chemically cleaned with inhibited chemicals, conversion coated with an acid chromate-fluoride-phosphate pretreatment; Organic coating shall be as specified below). Apply baked enamel in compliance with paint manufacturer's specifications for cleaning, conversion coating, and painting.

a. Organic Coating

Thermosetting modified acrylic enamel primer/topcoat system standard with manufacturer, with minimum dry film thickness of 1.5 mils, medium gloss.

b. Color

As shown on the Contract Drawings by reference to manufacturer's standard color designations.

6. High Performance Organic Coating

AA-C12C42R1x (Chemically cleaned with inhibited chemicals, conversion coated with an acid chromate-fluoride-phosphate pretreatment; Organic coating shall be as specified below) Prepare, pretreat, and apply coating to exposed, metal surfaces to comply with coating and resin manufacturer's instructions, using an entity approved by the coating manufacturer to apply its product.

a. Fluorocarbon 3-Coating System

Manufacturer's standard 3-coat thermo-cured system composed of specially formulated inhibitive primer, fluorocarbon color coat, and clear fluorocarbon topcoat, with both color coat and clear topcoat containing not less than 70 percent polyvinyldene resin by weight; complying with AAMA 605.2.

(1) Resin shall be Pennwalt Corporation's "Kynar 500" resin, 1.0 mil minimum dry film thickness.

(2) Color and gloss

As shown on the Contract Drawings by reference to manufacturer's standard color and sheen designations.

C. Paint Finish on Galvanized Steel Sheet (where shown on the Contract Drawings)

1. Surface Preparation

Clean surfaces of dirt, grease, and other contaminants. Follow by a conversion coating of type suitable for organic coating application. Clean welds, mechanical connections, and abraded areas. Follow by SSPC Paint 20 galvanizing repair paint applied in accordance with ASTM A 780.

2. Factory-Priming for Field-Painted Finish

Where field painting after installation is shown on the Contract Drawings, apply air-dried primer, specified in another Section of these Specifications entitled "Painting", immediately following cleaning and pretreatment.

D. Paint Finish (where shown on the Contract Drawings)

1. Surface Preparation

Solvent-clean surfaces in compliance with SSPC SP1 to remove dirt, oil, grease and other contaminants that could impair paint bond. Remove mill scale and rust, if present, from uncoated steel in compliance with SSPCSP5 (White Metal Blast Cleaning) or SSPCSP8 (Pickling).

2. Factory-Priming for Field-Painted Finish

Apply shop primer, specified in another Section of these Specifications entitled "Painting", immediately following surface preparation and pretreatment.

E. Baked Enamel Finish

To be used, where shown on the Contract Drawings as a steel or galvanized steel finish system.

1. Immediately after cleaning and pretreatment, apply manufacturer's standard 2-coat baked enamel finish, consisting of prime coat and thermosetting topcoat, with not less than 1.0 mils, dry film thickness for topcoat. Comply with paint manufacturer's instructions for application and baking to achieve a minimum dry film thickness of 2.0 mils.

   a. Color and Gloss

      As shown on the Contract Drawings by reference to manufacturer's standard color and sheen designations.

F. Stainless Steel Finishes

In accordance with 2.02 B.3 of this Section.

PART 3 - EXECUTION

3.01 PREPARATION

Coordinate setting drawings, diagrams, templates, instructions, and directions for the installation of anchorages, and miscellaneous items having integral anchors, which are to be embedded in concrete or masonry construction. Coordinate delivery of such items to the construction site.

3.02 INSTALLATION

A. Locate and place sheet metal fabrications plumb, level and in alignment with adjacent construction.

B. Use concealed anchorages where possible. Provide brass or lead washers fitted to screws where required to protect sheet metal surfaces and to make a weathertight connection.

C. Form tight joints with exposed connections accurately fitted together. Provide reveals and openings for joint sealers as shown on the Contract Drawings. Joint sealers for exposed joints are specified in a Division 7 Section of these Specifications.

D. Provide concealed gaskets, flashing, sealants, fillers and insulation, and install as the installation progresses to make installations weathertight or sealed.

E. Protect zinc-coated, galvanized and nonferrous metal surfaces from corrosion or galvanic action by application of a heavy coating of bituminous paint on surfaces which will be in contact with concrete, masonry or dissimilar metals.

3.03 ADJUSTMENTS

Repair finishes damaged during installation and construction period so that no evidence remains of correction. Return items which cannot be field refinished to the factory. Make required alterations and refinish entire unit, or provide new units as directed by the Engineer.

3.04 PROTECTION

Protect finishes of sheet metal fabrications from damage during construction period. Remove temporary protective coverings immediately prior to inspection for issuance of the Certificate of Partial or Final Completion, as applicable for the Work of this Contract.

END OF SECTION

SECTION 06100

ROUGH CARPENTRY

PART 1 - GENERAL

1.01 SUMMARY

This Section specifies requirements for rough carpentry. As used in this Section "rough carpentry" shall mean Work not specified as part of other Sections and which is generally not exposed, except as otherwise shown on the Contract Drawings.

1.02 REFERENCES

The following is a listing of the publications referenced in this Section.

American Plywood Association (APA)

APA Form No. E 30 F	Design/Construction Guide - Residential & Commercial
APA Form No. E 445	Performance Standard and Policies for Structural Use Panels

American Society for Testing and Materials (ASTM)

ASTM A 153	Zinc Coating (Hot-Dip) on Iron and Steel Hardware

American Wood Preservers Association (AWPA)

AWPA Standard C 2	Lumber, Timber, Bridge Ties and Mine Ties Pressure Treatment
AWPA Standard C 9	Plywood, Pressure Treatment
AWPA Standard C 20	Structural Lumber, Fire-Retardant Pressure Treatment
AWPA Standard C 27	Plywood, Fire-Retardant Pressure Treatment
AWPA Standard M 4	Care of Pressure-Treated Wood Products

American Wood Preservers Bureau (AWPB)

AWPB LP-2 Pressure Treated with Water-Borne Preservatives - Above Ground Use

AWPB LP-22 Pressure Treated with Water-Borne Preservatives - Ground Contact Use

United States Product Standard (PS)

PS 1 U.S. Product Standard for Construction and Industrial Plywood

PS 20 American Softwood Lumber Standard

1.03 DELIVERY, STORAGE, AND HANDLING

A. Keep materials under cover and dry. Protect against exposure to weather and contact with damp or wet surfaces. Stack lumber as well as plywood and other panels; provide for air circulation within, around stacks and under temporary coverings including polyethylene and similar materials.

1. For lumber and plywood pressure treated with waterborne chemicals, place a sticker between each course to provide air circulation.

1.04 SUBMITTALS

Submit the following in accordance with the requirements of "Shop Drawings, Catalog Cuts, and Samples" of Division 1 - GENERAL PROVISIONS:

A. Product Data

Manufacturer's specifications and installation instructions for Underlayment where shown on the Contract Drawings.

B. Material Certificates

Where dimensional lumber is provided to comply with minimum allowable unit stresses, submit listing of species and grade selected for each use, and submit evidence of compliance with specified requirements. Compliance may be in the form of a signed copy of applicable portion of lumber producer's grading rules showing design values for selected species and grade. Design values shall be as approved by the Board of Review of American Lumber Standards Committee.

C. Wood Treatment Data

Chemical treatment manufacturer's instructions for handling, storing, installation and finishing of treated material.

1. Preservative Treatment

For each type shown on the Contract Drawings, include certification by treating plant stating type of preservative solution and pressure process used, net amount of preservative retained and conformance with applicable standards.

2. For water-borne treatment include statement that moisture content of treated materials was reduced to levels indicated prior to shipment to construction site.

3. Fire-Retardant Treatment (where shown on the Contract Drawings)

Include certification by treating plant that treated material complies with specified standard and other requirements.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Lumber

1. Lumber Standards

Manufacture lumber to comply with PS 20 and with applicable grading rules of inspection agencies certified by the American Lumber Standards Committee's (ALSC) Board of Review.

2. Grade Stamps

Factory-mark each piece of lumber with grade stamp of inspection agency evidencing compliance with grading rule requirements and identifying grading agency, grade, species, moisture content at the time of surfacing, and mill.

a. For exposed lumber apply grade stamps to ends or back of each piece, or omit grade stamps entirely and issue a certificate of grade compliance from the inspection agency in lieu of grade stamp.

3. Nominal sizes are shown on the Contract Drawings except as shown by detail dimensions on the Contract Drawings. Provide actual sizes as required by PS 20, for moisture content specified for each use.

   a. Provide S4S dressed lumber, unless otherwise shown on the Contract Drawings.

   b. Provide seasoned lumber with 19 percent maximum moisture content at time of dressing and shipment for sizes 2 inches or less in nominal thickness, unless otherwise shown on the Contract Drawings.

B. Dimension Lumber, as follows unless otherwise shown on the Contract Drawings:

   1. For light framing (2 inches to 4 inches thick, 2 inches to 4 inches wide) provide any species of Construction grade.

   2. For structural light framing (2 inches to 4 inches thick, 2 inches to 4 inches wide), provide any species of No. 1 grade.

   3. For structural framing (2 inches to 4 inches thick, 5 inches and wide), any species of Select Structural grade.

C. Boards as follows, unless otherwise shown on the Contract Drawings:

   1. Exposed boards

      Where boards will be exposed in the finished Work, provide 19 percent maximum, "S-DRY" moisture content.

      a. Where transparent or natural finish or no finish is shown on the Contract Drawings, provide Redwood, Select Heart Grade per Redwood Inspection Service (RIS).

      b. Where painted finish is shown on the Contract Drawings provide No. 1 Boards per Southern Pine Inspection Bureau (SPIB) rules, Select Merchantable Boards per West Coast Lumber Inspection Bureau (WCLIB) rules, or No. 2 Common Boards and Better per Western Wood Products Association (WWPA) rules.

2. Concealed Boards

Where boards will be concealed by other Work, provide lumber of 19 percent maximum moisture content (S-DRY) and one of the following species and grade:

a. Redwood Construction Common per RIS rules

b. Southern Pine No. 2 Boards per SPIB rules

c. or any species graded Construction Boards per WCLIB or WWPA rules.

3. Board Sizes

Provide sizes shown on the Contract Drawings, or, if not shown, (for sheathing, subflooring and similar uses), provide 1 inch x 8 inches boards.

D. Miscellaneous Lumber

1. Provide wood for support or attachment of other Work including bucks, nailers, blocking, furring, grounds, stripping and similar members. Provide lumber of sizes and worked into shapes as shown on the Contract Drawings, and as follows:

a. Moisture content

19 percent maximum for lumber items not specified to receive wood preservative treatment.

b. Grade

Standard Grade light framing size lumber of any species or board size lumber as required for application as shown on the Contract Drawings, No. 3 Common or Standard grade boards per WCLIB or WWPA rules or No. 3 boards per SPIB rules.

E. Construction Panels

1. Construction Panel Standards

Comply with PS 1 for plywood panels and, for products not manufactured under PS 1 provisions, with APA Form No. E 445.

2. Trademark

Factory-mark each construction panel with APA trademark evidencing compliance with grade requirements.

3. Concealed APA Performance-Rated Panels

Where construction panels will be used for the following concealed types of applications as shown on the Contract Drawings, provide APA Performance-Rated Panels complying with requirements shown on the Contract Drawings for grade designation, span rating, exposure durability classification, edge detail (where applicable) and thickness.

a. Combination Subfloor-Underlayment: APA Rated Sturd-I-Floor.

(1) Exposure Durability Classification: Exterior

(2) Thickness: As shown on the Contract Drawings,

(3) Span Rating: As required to suit joist spacing shown on the Contract Drawings,

(4) Edge Detail: Tongue and groove, unless shown on the Contract Drawings,

(5) For resilient tile flooring application over combination subfloor - underlayment, where shown on the Contract Drawings, provide the following underlayment (over the above specified subfloor - underlayment):

(a) 1/4 inch thick, APA C-C PLUGGED exterior with sanded face.

b. Wall Sheathing: APA rated sheathing

(1) Exposure Durability Classification: Exterior

(2) Span Rating: As required to suit stud spacing shown on the Contract Drawings,

c. Roof Sheathing: APA rated sheathing

(1) Exposure Durability Classification: Exterior

(2) Span Rating: As required to suit rafter spacing shown on the Contract Drawings,

d. Plywood Backing Panels

For mounting electrical or telephone equipment, provide fire-retardant treated plywood panels with grade designation, APA C-D PLUGGED INT with exterior glue, in thickness shown on the Contract Drawings, or, if not otherwise shown not less than 15/32 inch.

F. Miscellaneous Materials

1. Fasteners and Anchorages

Provide size, type, material and finish as shown on the Contract Drawings and as recommended by applicable standards, complying with applicable Federal Specifications for nails, staples, screws, bolts, nuts, washers and anchoring devices. Provide metal hangers and framing anchors of the size and type recommended by the manufacturer for each use including recommended nails.

a. Where shown on the Contract Drawings and/or rough carpentry Work is exposed to weather, in ground contact, or in area of high relative humidity, provide fasteners and anchorages with a hot-dip zinc coating conforming to ASTM A 153.

2. Building Paper (where shown on the Contract Drawings)

ASTM D 226, Type I; asphalt saturated felt, non-perforated, 15-lb. type.

G. Preservative Treatment

1. Where lumber or plywood is shown on the Contract Drawings, as "Trt-Wd" or "Treated," or is specified in this Section to be treated, comply with applicable requirements of AWPA Standard C 2 (Lumber), AWPA Standard C 9 (Plywood) and of AWPB Standards listed below. Mark each treated item with the AWPB Quality Mark Requirements.

a. Pressure-treat above-ground items with water-borne preservatives to comply with AWPB LP-2. After treatment, kiln-dry lumber and plywood to a maximum moisture content, respectively, of 19 percent and 15 percent. Treat items shown on the Contract Drawings, and the following:

(1) Wood cants, nailers, curbs, equipment support bases, blocking, stripping, and similar members in connection with flashing, vapor barriers and waterproofing.

(2) Wood sills, sleepers, blocking, furring, stripping and similar concealed members in contact with masonry or concrete.

b. Pressure-treat wood members shown on the Contract Drawings as being in contact with the ground with water-borne preservatives complying with AWPB LP-22

2. Complete fabrication of treated items prior to treatment, where possible. If cut after treatment, coat cut surfaces with heavy brush coat of same chemical used for treatment and to comply with AWPA Standard M 4. Inspect each piece of lumber or plywood after drying and discard damaged or defective pieces.

H. Fire-Retardant Treatment

Where fire-retardant treated wood ("FRTW") is shown on the Contract Drawings, pressure impregnate lumber and plywood with fire-retardant chemicals to comply with AWPA C 20 and AWPA C 27, respectively. Treatment Type A at interior applications and exterior type for exterior applications shown on the Contract Drawings. Identify "FRTW" lumber with appropriate classification marking of Underwriters Laboratories, Inc., U.S. Testing, Timber Products Inspection or other testing and inspecting agency acceptable to the Engineer.

1. Inspect each piece of treated lumber or plywood after drying and discard damaged or defective pieces.

PART 3 - EXECUTION

3.01 INSTALLATION

A. General

1. Discard units of material with defects which might impair quality of Work, and units which are too small to use in fabricating Work with minimum joints or optimum joint arrangement.

2. Set carpentry Work to required levels and lines, with members plumb and true to line and cut and fitted.

3. Securely attach carpentry Work to substrate by anchoring and fastening as shown on the Contract Drawings, or if not shown, as required by industry standards.

4. Countersink nail heads on exposed carpentry Work and fill holes.

5. Use common wire nails, except as otherwise shown on the Contract Drawings. Use finishing nails for finish Work. Select fasteners of size that will not penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections between members. Install fasteners without splitting of wood; predrill as required.

B. Wood Grounds, Nailers, Blocking and Sleepers

1. Provide wherever shown on the Contract Drawings, and where required for screeding or attachment of other Work. Form to shapes as shown and cut as required for true line and level of Work to be attached. Coordinate location with other Work involved.

2. Attach to substrates as required to support applied loading. Countersink bolts and nuts flush with surfaces, unless otherwise shown on the Contract Drawings. Build into masonry during installation of masonry work. Where possible, anchor to formwork before concrete placement.

3. Where plaster application is shown on the Contract Drawings, provide permanent grounds of dressed, preservative treated, key-bevelled lumber not less than 1-1/2 inches wide and of thickness required to bring face of ground to exact thickness of finish material involved. Remove temporary grounds when no longer required.

C. Wood Furring

1. Install plumb and level with closure strips at edges and openings. Shim with wood as required for tolerance of finished Work. Firestop furred spaces on walls at each floor level and at ceiling line of top story, with wood blocking or noncombustible materials, accurately fitted to close furred spaces.

2. Provide the following types of wood furring, where shown on the Contract Drawings:

a. Furring to receive plywood paneling

Unless otherwise shown, provide 1 inch x 3 inches furring at 2 feet o.c., horizontally and vertically. Select furring for freedom from knots capable of producing bent-over nails and resulting damage to paneling.

b. Furring to receive gypsum drywall and plaster lath

Unless otherwise shown, provide 1 inch x 2 inches furring at 16 inches o.c., vertically.

c. Suspended Furring

Provide size and spacing shown, including hangers and attachment devices. Level to a tolerance of 1/8 inch in 10 feet, except 1/4 inch in 10 feet for thick-coat plaster work.

D. Wood Framing

1. Provide framing members of sizes and on spacings shown on the Contract Drawings, and frame openings as shown. Do not splice structural members between supports.

2. Anchor and nail as shown on the Contract Drawings.

3. Firestop concealed spaces of wood framed walls and partitions at each floor level and at the ceiling line of the top story. Where firestops are not automatically provided by the framing system used, use closely-fitted wood blocks of nominal 2 inch thick lumber of the same width as framing members.

4. Construct corners and intersections with not less than 3 studs. Provide miscellaneous blocking and framing as shown on the Contract Drawings and as required for support of facing materials, fixtures, specialty items and trim.

E. Installation of Construction Panels

1. Comply with applicable recommendations contained in Form No. E 30F, "APA Design/Construction Guide Residential & Commercial," for types of construction panels and applications as shown on the Contract Drawings.

2. Fastening Methods

Fasten panels as follows:

a. Combination Subflooring-Underlayment: Nail to framing.

b. Sheathing and underlayment: Nail or staple to framing.

(1) Fill and sand edge joints of underlayment receiving resilient flooring.

c. Plywood Backing Panels: Nail to supports.

END OF SECTION

SECTION 07212

BLANKET TYPE BUILDING INSULATION-FOIL FACED

PART 1 - GENERAL

1.01 SUMMARY

This Section specifies requirements for blanket thermal insulation.

1.02 REFERENCES

The following is a listing of the publications referenced in this Section:

American Society for Testing and Materials (ASTM)

ASTM C 665 - Mineral-Fiber Blanket Thermal Insulation for Light Frame Mineral-Construction and Manufactured Housing

ASTM E 84 - Test Method for Surface Burning Characteristics of Building Materials

ASTM E 136 - Test Method For Behavior of Materials in a Vertical Tube Furnace at 750 degrees C

Code of Federal Regulations (CFR) 40 CFR Part 763 Subpart F "Friable Asbestos-Containing Materials in Schools"

Underwriters Laboratories Inc. (UL)

Fire Resistive Directory

1.03 QUALITY ASSURANCE

A. Thermal Resistance

Where thermal resistance properties of insulating materials are designated by "R-values", they represent the reciprocal of thermal conductance ("C-value"). Thermal conductance is the rate of heat flow through a material of thickness shown on the Contract Drawings. Thermal resistances ("R-values") are expressed by the temperature difference in degrees F between the two exposed faces required to cause one BTU to flow through one square foot per hour at mean temperatures indicated in ASTM C 665.

B. Fire Performance Characteristics

Provide insulation materials which are identical to those whose fire performance characteristics are listed in UL Fire Resistance Directory or other applicable publication for each material or assembly of which insulation is a part. Fire performance characteristics must be determined by testing, per methods indicated below, by Underwriters Laboratories Inc. or other testing and inspecting agency approved by the Engineer.

1. Surface Burning Characteristics: ASTM E 84.

2. Combustion Characteristics: ASTM E 136.

C. Maximum Allowable Asbestos Content of Inorganic Insulation

Provide insulation composed of mineral fibers or mineral ores which contain less than 0.25 percent by weight of asbestos of any type or mixture of types occurring naturally as impurities as determined by polarized light microscopy test per Appendix A of 40 CFR 763, Subpart F.

1.04 DELIVERY, STORAGE AND HANDLING

Protect insulation from physical damage and from becoming wet, soiled, or covered with ice or snow. Comply with manufacturer's recommendations for handling, storage and protection during installation.

1.05 SUBMITTALS

A. Submit manufacturer's product literature and installation instructions for insulation and vapor retarder in accordance with the requirements of "Shop Drawings, Catalog Cuts, and Samples" of Division 1 - GENERAL PROVISIONS.

B. Certified Test Reports

With product data, submit copies of certified test reports showing compliance with specified performance values, including "R-values", densities, compression strengths, fire performance characteristics, perm ratings, water absorption ratings and similar properties.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

Subject to compliance with requirements of this Section, provide products of one of the following:

CertainTeed Corp., Valley Forge, PA
Knauf Fiber Glass Corp., Shelbyville, IN
Manville Corp., Denver, CO
Owens-Corning Fiberglas Corp., Toledo, OH

2.02 MATERIALS

Faced Mineral Fiber Blanket/Batt Insulation

Thermal insulation with overlapping face tabs on both sides produced by combining mineral fibers manufactured from glass or slag with thermosetting resins which comply with ASTM C 665 for Type III, Class A (blankets with reflective vapor-retarder membrane facing with flame spread of 25 or less); foil-scrim-kraft vapor-retarder membrane on one face, respectively; and as follows:

A. Combustion Characteristics

Unfaced blanket passes ASTM E 136 test.

B. Surface Burning Characteristics

Maximum ASTM E 84 flame spread and smoke developed values of 25 and 50, respectively.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Clean substrates of substances harmful to insulation, including removal of projections which might puncture vapor retarders.

B. Comply with the manufacturer's instructions for particular conditions of installation in each case. If printed instructions are not available or do not apply to project conditions, consult manufacturer's technical representative for specific recommendations before proceeding with Work.

C. Extend insulation full thickness over entire area to be insulated. Leave no gaps or voids. Cut and fit tightly around obstructions, and fill voids with insulation. Remove projections which interfere with placement.

D. Apply a single layer of insulation of required thickness, unless otherwise shown on the Contract Drawings or required to make up total thickness.

E. Apply insulation units to substrate by method shown on the Contract Drawings complying with the manufacturer's recommendations. If no specific method is shown, bond units to substrate with adhesive or use mechanical anchorage to provide permanent placement and support of units.

F. Unless otherwise shown on the Contract Drawings, place vapor and air barrier on warm side of insulation. Provide not less than 0.75 inch air space where possible.

3.02 PROTECTION

Protect installed insulation from harmful weather exposures and from possible physical abuses, where possible by nondelayed installation of concealing Work or, where that is not possible, by temporary covering or enclosure.

END OF SECTION

SECTION 07250

SPRAYED-ON CEMENTITIOUS FIREPROOFING - LIGHT DENSITY

PART 1 - GENERAL

1.01 SUMMARY

This Section specifies requirements for sprayed-on cementitious fireproofing - light density.

1.02 REFERENCES

The following is a listing of the publications referenced in this Section:

American Society for Testing and Materials (ASTM)

ASTM C 569	-	Test Method for Indentation Hardness of Preformed Thermal Insulations
ASTM D 2240	-	Test Method for Rubber Property - Durometer Hardness
ASTM E 84	-	Test Method for Surface Burning Characteristics of Building Materials
ASTM E 119	-	Method for Fire Tests of Building Construction and Materials.
ASTM E 605	-	Test Methods for Thickness and Density of Sprayed Fire Resistive Material Applied to Structural Members
ASTM E 736	-	Test Method for Cohesion/Adhesion of Sprayed Fire Resistive Materials Applied to Structural Members
ASTM E 759	-	Test Method for Effect of Deflection of Sprayed Fire Resistive Material Applied to Structural Members
ASTM E 760	-	Test Method for Effect of Impact on Bonding of Sprayed Fire Resistive Material Applied to Structural Members

ASTM E 761 - Test Method for Compressive Strength of Sprayed Fire Resistive Material Applied to Structural Members

ASTM E 859 - Test Method for Air Erosion of Sprayed Fire Resistive Materials Applied to Structural Members

ASTM E 937 - Test Method for Corrosion of Steel by Sprayed Fire Resistive Material Applied to Structural Members

Federal Specifications (FS)

SS-S-111 - Sound Controlling Materials (Trowel and Spray Applications)

Underwriters Laboratories, Inc. (UL)

Fire Resistance Directory

United States Environmental Protection Agency (USEPA)

40 CRF 763.87

1.03 ENVIRONMENTAL REQUIREMENTS

A. Do not apply fireproofing when the ambient temperature and/or the temperature of the substrate is below 40 degrees F or below the temperature recommended in the manufacturer's printed instructions, whichever is higher. Maintain such minimum ambient temperature for a minimum of 24 hours before and after application.

B. In areas without natural ventilation, provide temporary equipment to mechanically circulate and exhaust interior air to the outside.

C. In addition to safety requirements specified elsewhere in this Section, provide protection as follows:

1. Provide approved temporary enclosures to prevent spray from contaminating air in adjacent areas.

2. Protect adjacent surfaces and equipment from damage by overspray, fall-out, and dusting of sprayed-on fireproofing materials.

3. Clean up and remove fallout and debris prior to removal of protective enclosures.

4. Notify the Engineer at least one week in advance of the type and number of heaters to be used, if any, and of safety measures to be employed in the handling and use of fuel for heaters.

1.04 QUALITY ASSURANCE

A. The entity performing application Work of this Section shall be approved by the manufacturer of fireproofing material and shall have had a minimum of five years experience on Work of this type, including at least two projects involving quantities and complexities at least equal to those required for Work of this Section.

B. Single Source Responsibility

Provide sprayed-on fireproofing materials from a single manufacturer for each product required.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Deliver material in original unopened packages, containers or bundles bearing brand name and identification of the manufacturer.

B. Store materials off the ground, under cover and away from damp surfaces. Keep materials dry at all times.

C. Packages which are damaged or which show evidence that moisture has penetrated the wrapping will be rejected and shall be removed from the construction site.

1.06 SUBMITTALS

A. Submit the following in accordance with the requirements of "Shop Drawings, Catalog Cuts, and Samples" of Division 1 GENERAL PROVISIONS:

1. List certified by manufacturer, showing minimum thicknesses of fireproofing required to satisfy hourly ratings shown on the Contract Drawings for all members and areas to be coated including the applicable design numbers from the Underwriters Laboratories, "Fire Resistance Directory" for each case.

2. Where primers are shop or field applied to steel, submit statement from primer manufacturer(s), certifying that primers are compatible with sprayed-on fireproofing and will not impair its performance under fire exposure for applications intended as proved by ASTM E 119 test. Include test and other data as evidence; distribute data to sprayed-on fireproofing manufacturer, and send notification of transmission to the Engineer.

3. Approval of steel primers by sprayed-on fireproofing manufacturer, based on data submitted by primer manufacturer.

4. Test reports

   Submit the following for the fireproofing material that will actually be installed under this Contract:

   a. Certified test reports from an independent testing laboratory verifying that fireproofing meets the requirements of the ASTM and Federal Specifications cited in this Section and as required by 3.01 A.2 and 3.01 C.1 of this Section.

   b. Evidence that fireproofing meets the requirements for Fire Hazards Classification of the Underwriters Laboratories.

   c. New tests and reports will be required at any time when, in the opinion of the Engineer, there is any evidence that the material on which the tests are run are not representative of the material being furnished.

5. Shop Drawings

   Complete details of metal lath reinforcement, if any.

B. Manufacturer's Instructions

   Submit for the Engineer's information, the manufacturer's printed instructions and specifications for handling, mixing and type of equipment required for installation of the fireproofing.

C. The Contractor shall submit the manufacturer's notification of approval of the entity performing the application Work of this Section.

D. The Contractor shall submit the site report as required by 3.01 A.3 of this Section.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. General

1. Provide primary sprayed-on fireproofing product(s) of the Manufacturer(s) listed in 2.01 B of this Section, which shall be an asbestos-free cementitious mixture conforming to requirements of 2.03 of this Section.

2. Provide auxiliary fireproofing materials as shown on the Contract Drawings or if not shown, then as recommended by the primary fireproofing manufacturer(s).

B. Sprayed-On Fireproofing

"Monokote - 6 (MK-6)" or "Retrogard (R-6)", where asbestos abatement Work is shown on the Contract Drawings on surfaces to receive sprayed on fireproofing; Grace Construction Products Division, W. R. Grace Co., Cambridge, MA

2.02 MATERIALS

Auxiliary Fireproofing Materials

Provide the following materials, as required for conditions shown on the Contract Drawings, which are compatible with approved primary sprayed-on fireproofing, and which have been approved by UL or other testing and inspection agency acceptable to the Engineer for the fire-resistance design(s):

A. Substrate primers

B. Adhesive for bonding fireproofing

C. Metal Lath

Expanded metal lath fabricated from material of weight, configuration and finish required to comply with fire-resistance rated design(s) shown on the Contract Drawings and fireproofing manufacturer's recommendations. Include clips, lathing accessories, and other anchorage devices required to attach lath to substrate(s).

D. Topcoats

Type as recommended by manufacturer(s) of fireproofing materials(s) required for application(s) shown on the Contract Drawings.

2.03 CONSTRUCTION FEATURES

A. Flame spread shall be 10 or less, per ASTM E 84.

B. Smoke developed shall be 0, per ASTM E 84.

C. Dusting shall comply with FS SS-S-111.

D. Bond strength shall be 80 lbs. force per sq. ft. per ASTM E 736.

E. Compressive strength shall be 3.47 psi per ASTM E 761.

F. Corrosion Resistance

No evidence of corrosion per ASTM E 937.

G. Deflection

No cracking, spalling, delamination or the like, per ASTM E 759.

H. Effect of Impact on Bonding

No cracking, spalling, delamination or the like per ASTM E 760.

I. Air Erosion

Maximum weight loss of 0.025 gram per square foot, per ASTM E 859.

J. Dry Density

As required for fire-resistance rating shown on the Contract Drawings, per ASTM E 605, but not less than 14 lbs. per cubic foot.

K. Hardness

0.50 inch maximum penetration per ASTM C 569 (for concealed applications), 10 per ASTM D 2240, Type D Durometer (for exposed applications).

L. Asbestos Content

No asbestos fibers per PLM test method/USEPA 40 CRF 763.87.

2.04 MIXES

Provide materials to produce the hourly fireproofing rating(s) for the building construction classification as shown on the Contract Drawings.

PART 3 - EXECUTION

3.01 PREPARATION

A. After review and approval of required certifications, the Engineer will hold a meeting at the construction site, with representatives of the Contractor, the manufacturer of the fireproofing and the entity performing the application Work for this Section.

1. The Contractor shall determine, record and implement the methods and techniques of application including masking and protection of adjacent surfaces, heating requirements, and clean-up.

2. The group shall inspect the substrate and the Contractor shall determine what repairs have to be made such as scraping loose defective paint and loose rust, removal of grease, oil, dirt and other foreign materials and measures to be employed to ensure an adequate bond. If surfaces are primed or painted, perform a bond test per ASTM E 736 to assure compatibility of materials and an adequate bond. Submit test results to the Engineer.

3. The Contractor shall prepare a report of determinations made at the meeting and shall submit a copy to the Engineer for his approval.

B. Sequence and coordinate application of sprayed-on fireproofing with other related Work specified in other Sections to comply with the following requirements:

1. Prevent deterioration of sprayed-fireproofing for interior applications due to exposure to unfavorable environmental conditions.

2. Avoid unnecessary exposure of sprayed-on fireproofing to abrasion and other damage likely to occur during construction operations subsequent to its application.

3. Ensure that sprayed-on fireproofing is installed prior to installation of enclosing or concealing Work, if any, with sufficient time allowed for inspection, testing and correction of defective fireproofing.

4. Ensure that construction Work likely to cause deflection of steel deck and structural steel has been performed prior to the application of sprayed-on fireproofing.

C. Substrate Preparation

1. In the event that, in the opinion of the Engineer, the suitability of a particular substrate could not be determined at said meeting, apply full depth sprayed-on fireproofing to a small section and after it has completely dried and cured, test it for adhesion per ASTM E 736. Submit test results to the Engineer.

2. Perform corrective measures required for defective substrate and cleaning required to properly prepare substrate to obtain proper bond.

D. Trial Beams

1. For each type of sprayed fireproofing to be used, prepare a trial beam at the construction site. Do not proceed with the application of fireproofing until the trial beam has been approved by the Engineer.

2. All production fireproofing application shall match the appropriate approved trial beam.

3.02 APPLICATION

A. Mixing and application of materials shall comply with the manufacturer's printed instructions.

B. Apply by sprayed-on method to the maximum extent possible, with thickness and density not less than that required to achieve fire resistance ratings shown on the Contract Drawings.

C. To ensure minimal overspray and to provide increased resistance to vibration, apply with a maximum nozzle length of 5 feet.

D. All finished surfaces shall be free of cracks, holes and pits.

E. Masking and Filling of Voids

1. Beams and girders under steel decking or concrete slabs, that will be exposed in the finished construction, shall be fireproofed so as to provide a minimum of two inches coverage of the deck beyond the limits of the top flange of beam or girder. This shall be accomplished by masking the portions of decking or slab not to be covered so as to provide straight lines parallel to the flanges.

2. Completely fill voids between metal deck ribs directly above the upper edge of steel beams or girders running perpendicular to the ribs with fireproofing material or other approved method of providing the required hourly protection of the upper flanges of beams and girders.

F. Where shown on Contract Drawings, apply top coat to fireproofing.

3.03 FIELD TESTS

A. The Engineer will perform a minimum of one series of the following tests for each 10,000 sq. ft. of floor area and inspect as follows:

1. Applied thickness and dry density of samples in accordance with ASTM E 736 removed from actual installation at random locations.

2. Adhesion and cohesion of cured fireproofing in accordance with ASTM E 736.

B. Inspect for compliance with other requirements of this Section.

C. Furnish all labor, materials and equipment required to assist the Engineer in the above described inspection and testing, including but not limited to the following:

1. Make scaffolding and other equipment available as necessary to permit access to all portions of the installation.

2. Cut samples from completed installation(s) and prepare wet sample, when and as directed by the Engineer.

D. Repair or replace fireproofing within area(s) where test results indicate fireproofing does not comply with requirements at no cost to the Authority.

3.04 PROTECTION

Protect fireproofed construction at all times so that fireproofing will be without damage or deterioration at the time of issuance of the Certificate of Final Completion.

END OF SECTION

SECTION 07920

SILICONE SEALANTS

PART 1 - GENERAL

1.01 SUMMARY

This Section specifies the requirements for silicone sealants.

1.02 REFERENCES

The following is a listing of the publications referenced in this Section:

American Architectural Manufacturers Association (AAMA)

AAMA CW-13	Structural Sealant Glazing Systems

American Society for Testing and Materials (ASTM)

ASTM C 719	Test Method for Adhesion and Cohesion of Elastromeric Joint Sealants Under Cycle Movement
ASTM C 920	Elastomeric Joint Sealants
ASTM C 962	Guide for Use of Elastomeric Joint Sealants
ASTM D 412	Test Methods for Rubber Properties in Tension
ASTM D 1056	Flexible Cellular Materials - Sponge or Expanded Rubber

1.03 DESIGN AND PERFORMANCE REQUIREMENTS

Comply with the following in accordance with the requirements of "Workmanship and Materials", of Division 1 - GENERAL PROVISIONS:

A. Submit manufacturer's certification that sealants comply with requirements of 2.02A. herein.

B. For sealants designated as ES-1 or ES-3 on the Contract Drawings, submit manufacturer's certification that tensile strength is not less than 45 nor more than 75 psi at 100 percent elongation when tested 14 days after application at 77 degrees F and 50 percent relative humidity in accordance with ASTM D 412.

C. For sealants designated as ES-2 on the Contract Drawings, submit manufacturer's certification that sealant adhesion and cohesion under maximum cyclic movement, per ASTM C 719, shall withstand a 50 percent increase and decrease of joint width as measured at time of application, and remain in compliance with other requirements of ASTM C 920.

D. When directed by the Engineer, perform preconstruction field adhesion test of each sealant as per AAMA CW-13. Perform such test(s) in the presence of the Engineer and a qualified technical representative of the sealant manufacturer.

1. Sealants not evidencing adhesive failure from testing, in absence of other indications of non-compliance with the above requirements, will be considered satisfactory. Do not use sealants which fail to adhere to joint substrates during testing.

2. Submit test report results.

1.04 ENVIRONMENTAL REQUIREMENTS

Do not proceed with the Work of this Section under the following conditions:

A. When ambient and substrate temperature conditions are outside the limits permitted by sealant manufacturer(s).

B. When joint substrates are wet due to rain, frost, condensation, or other causes.

C. Where joint widths are less than allowed by sealant manufacturer(s) for application(s) shown on the Contract Drawings.

D. When contaminants capable of interfering with sealant adhesion are present on joint substrates(s).

1.05 QUALITY ASSURANCE

A. The entity performing installation Work of this Section shall have successfully completed within the last 3 years at least 3 joint sealer installations involving quantities and complexities at least equal to those required for the Work of this Section.

B. Obtain joint sealer materials from a single manufacturer for each different product required.

1.06 DELIVERY,STORAGE, AND HANDLING

A. Deliver materials to construction site in original unopened containers or bundles with labels clearly identifying the manufacturer, product name and designation, color, expiration period for use, pot life, curing time and mixing instructions for multicomponent materials.

B. Store and handle materials to prevent deterioration or damage due to moisture, temperature changes, contaminants, or other causes.

1.07 SUBMITTALS

A. Submit the following in accordance with the requirements of "Shop Drawings, Catalog Cuts, and Samples" of Division 1 - GENERAL PROVISIONS:

1. Product Data

Manufacturer's product data for each joint sealant product, joint sealant backing and accessory required, including instructions for joint preparation and joint sealer application.

2. Certifications

Certificates from joint sealant manufacturer(s) attesting that their products comply with the requirements specified in this Section and are suitable for the use shown on the Contract Drawings.

a. When required by 1.03 A of this Section, submit specified manufacturer's certifications.

3. Test Reports

a. Preconstruction field adhesion test report results, when required by 1.03 A of this Section.

b. Compatibility and adhesion test reports from sealant manufacturer(s) indicating that materials forming joint substrates and joint sealant backings have been tested for compatibility and adhesion with joint sealants. Include sealant manufacturer's interpretation of test results relative to sealant performance, and recommendations for primers and substrate preparation needed to obtain adhesion.

4. When required by 2.02 A.5 of this Section, submit two separate bead sample strips of manufacturer's standard colors showing full range of colors available, for each product exposed to view.

B. Prior to start of Work of this Section, submit the following to the Engineer:

1. Evidence of installer's experience in accordance with 1.05 A of this Section.

2. One copy of U.S. Department of Labor Material Safety Data Sheets (MSDS) for hazardous or toxic chemicals, if any proposed for use during Work of this Section.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

Subject to compliance with the requirements of 1.03, 1.05 B and 2.02 A of this Section, provide products of the following manufacturers, or approved equal:

A. Where sealant designated as ES-1 (One-part non-acid curing silicone) is shown on Contract Drawings:

a. "Dow Corning 795", Dow Corning Corp., Midland, MI

b. General Electric Co., Silicone Products Div., Waterford, NY

(1) "Silpruf SCS 2000"

(2) "Gesil N SCS 2600"

c. "Spectrum 2", Tremco Inc., Cleveland, OH

B. Where sealant designated as ES-2 (One-part acid curing silicone) is shown on Contract Drawings:

a. "Dow Corning 786", Dow Corning Corp.

b. General Electric Co.

(1) "SCS 1000"

(2) "Construction 1200"

c. "Proglaze", Tremco Inc.

C. Where sealant designated as ES-3 (One-part mildew-resistant silicone) is shown on Contract Drawings:

a. "Dow Corning 786", Dow Corning Corp.

b. "SCS 1702 Sanitary", General Electric Co.

c. "Proglaze White", Tremco Inc.

2.02 MATERIALS

A. Sealants shall conform to the following requirements of ASTM C 920:

1. Type: S

2. Grade: NS

3. Class: 25

4. Use: T, NT, M, G, A or O as applicable to joint substrate shown.

5. Color

a. In stone or masonry joints: Match adjacent mortar color, unless otherwise shown on the Contract Drawings.

b. At other locations: As shown on the Contract Drawings, or if not shown, as selected by the Engineer from manufacturer's standard colors.

B. Joint Sealant Backing

Provide sealant backings of material and type which are nonstaining; are compatible with joint substrates, sealants, primers and other joint fillers; and are approved by sealant manufacturer for application(s) shown on the Contract Drawings, based on field experience and laboratory testing.

1. Plastic foam joint fillers, where shown on the Contract Drawings, shall be preformed, compressible, resilient, non-waxing, non-extruding strips of plastic foam of material depth and otherwise contribute to producing optimum sealant performance.

a. Either flexible, open cell polyurethane foam or non-gassing, closed-cell polyethylene foam subject to approval of sealant manufacturer.

2. Elastomeric tubing joint-fillers, where shown on the Contract Drawings shall be neoprene, butyl or EPDM tubing complying with ASTM D 1056, non-absorbent to water and gas, capable of remaining resilient at temperatures down to -26 degrees F. Provide products with low compression set and of size and shape to provide a secondary seal, to control sealant depth and otherwise contribute to optimum sealant performance.

2.03 ACCESSORIES

A. Bond-Breaker Tape

Polyethylene tape or other plastic tape as recommended by sealant manufacturer for preventing bond between sealant and joint filler or other materials at back (third) surface of joints. Provide self-adhesive tape where applicable.

B. Primer

Provide type recommended by joint sealer manufacturer where required for adhesion of sealant to joint substrates shown on the Contract Drawings.

C. Cleaners for Nonporous Surfaces

Provide non-staining, chemical cleaner of type acceptable to manufacturer of sealant and sealant backing materials which are not harmful to substrates and adjacent nonporous materials.

D. Masking Tape

Provide non-staining, non-absorbent type compatible with joint sealants and to surfaces adjacent to joints.

E. Vent Tubes (Weep Holes)

Provide heat-bendable acrylic tubes, of proper diameter and approved by the sealant manufacturer where shown on the Contract Drawings and as required to direct moisture to the outside of the building.

PART 3 - EXECUTION

3.01 EXAMINATION

The entity performing sealant installation shall inspect joints shown on the Contract Drawings to receive joint sealers for compliance with requirements for joint configuration, installation tolerances and other conditions affecting joint sealer performance. Do not allow joint sealant Work to proceed unless unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Surface Cleaning of Joints

Clean out joints immediately before installing joint sealers to comply with recommendations of joint sealer manufacturer(s) and the following requirements:

1. Remove foreign material from joint substrates which could interfere with adhesion of joint sealer, including dust; paints, except for permanent, protective coatings tested and approved for sealant adhesion and compatibility by sealant manufacturer; oil; grease; waterproofing; water repellants; water; surface dirt and frost.

2. Clean concrete, masonry, unglazed surfaces of ceramic tile and similar porous joint substrate surfaces, by brushing, grinding, blast cleaning, mechanical abrading, acid washing or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealers. Remove loose particles remaining from cleaning operations by vacuuming or blowing out joints with oil-free compressed air.

3. Remove laitance and form release agents from concrete.

4. Clean metal, glass, porcelain enamel, glazed surfaces of ceramic tile and other non-porous surfaces by chemical cleaners or other means which are not harmful to substrates or leave residues capable of interfering with adhesion of joint sealers.

B. Joint Priming

Prime joint substrates where shown on the Contract Drawings, or if not shown, as recommended by the joint sealer manufacturer. Apply primer to comply with joint sealer manufacturer's recommendations. Confine primers to areas of joint sealer bond, do not allow spillage or migration onto adjoining surfaces.

C. Masking

Use masking tape where required to prevent contact of sealant with adjoining surfaces which otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

3.03 INSTALLATION

A. General

Comply with joint sealer manufacturers' printed installation instructions and recommendations of ASTM C 962 for use of joint sealants as applicable to materials, applications and conditions shown on the Contract Drawings.

B. Sealant Backings: Install to comply with the following requirements:

1. Install joint-fillers of type shown on the Contract Drawings, or if not shown, in accordance with 3.03 A of this Section, to provide support of sealants during application and at position required to produce the cross-sectional shapes and depths of installed sealants relative to joint widths to allow optimum sealant movement capability.

   a. Do not leave gaps between ends of joint fillers.

   b. Do not stretch, twist, puncture or tear joint-fillers.

   c. Remove absorbent joint-fillers which have become wet *prior to sealant application* and replace with dry material.

2. Install bond breaker tape between sealants and joint-fillers, compression seals, or back of joints where required to prevent third-side adhesion of sealant to back of joint.

3. Install compressible seals serving as sealant backings to comply with requirements of 3.03 B.1 of this Section for joint fillers.

C. Sealants

Install by proven techniques that result in sealants directly contacting and fully wetting joint substrates, completely filling recesses provided for each joint configuration and providing uniform, cross-sectional shapes and depths relative to joint widths which allow optimum sealant movement capability.

D. Tooling

Immediately after sealant application and prior to time skinning or curing begins, tool sealants to form smooth, uniform beads of configuration as shown on the Contract Drawings, to eliminate air pockets and to ensure contact and adhesion of sealant with sides of joint. Remove excess sealants from surfaces adjacent to joint. Do not use tooling agents which discolor sealants or adjacent surfaces or are not approved by sealant manufacturer.

1. Concave joint configuration per Figure 6A in ASTM C 962, unless otherwise shown on the Contract Drawings.

2. Flush joint configuration per Figure 6B in ASTM C 962, where shown on the Contract Drawings.

3. Recessed joint configuration per Figure 6C in ASTM C 962, of recess depth and at locations shown on the Contract Drawings.

   a. Use masking tape to protect adjacent surfaces of recessed tooled joints.

E. Clean off excess sealants or sealant smears adjacent to joints as Work progresses by methods and with cleaning materials approved by manufacturers of joint sealers and of products in which joints occurred.

3.04 PROTECTION

Protect joint sealers during and after curing period from contact with contaminating substances or from damage resulting from construction operations or other causes so that they are without deterioration or damage at time of issuance of the Certificate of Final Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated joint sealers immediately and reseal joints with new materials to produce joint sealer installations with repaired areas indistinguishable from original Work, at no cost to the Authority.

END OF SECTION

SECTION 08110

CUSTOM HOLLOW METAL

PART 1 - GENERAL

1.01 SUMMARY

A. This Section specifies the requirements for custom hollow metal Work for doors, frames and related openings; and metal panels and louvers installed therein.

B. Building in of anchors and grouting of frames in masonry construction, if any, is specified in a Division 4 Section of these Specifications.

C. Finish hardware installation for doors is specified in the Section of these Specifications entitled "Finish Hardware".

D. Glazing, if any, of Work of this Section is specified in another Division 8 Section of these Specifications.

1.02 REFERENCES

The following is a listing of the publications referenced in this Section:

American Nationals Standards Institute, Inc. (ANSI)

ANSI A 115	Series Door and Frame Preparation

American Society for Testing and Materials (ASTM)

ASTM A 153	Zinc Coating (Hot-Dip) on Iron and Steel Hardware
ASTM A 167	Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip
ASTM A 366	Steel, Carbon, Cold-Rolled Sheet, Commercial Quality
ASTM A 525	General Requirements for Steel Sheet, Zinc Coated (Galvanized) by the Hot-Dip Process
ASTM A 526	Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process, Commercial Quality

ASTM A 569	Steel, Carbon (0.15 maximum percent), Hot-rolled Sheet and Strip, Commercial Quality
ASTM B 117	Method of Salt Spray (Fog) Testing
ASTM C 236	Test Method for Steady-State Thermal Performance of Building Assemblies by Means of a Guarded Hot Box
ASTM E 90	Method for Laboratory Measurement of Airborne-Sound Transmission Loss of Building Partitions
ASTM E 152	Methods for Fire Tests of Door Assemblies
ASTM E 413	Classification for Determination of Sound Transmission Class
ASTM F 476	Test Methods for Security of Swinging Door Assemblies

Door and Hardware Institute (DHI) publication "Recommended Locations for Builders Hardware for Custom Steel Doors and Frames"

National Fire Protection Association (NFPA)

NFPA 80, Fire Doors and Windows

Steel Structures Painting Council (SSPC)

SSPC - PT-2	Cold Phosphate Surface Treatment
SSPC - PT-4	Hot Phosphate Surface Treatment

Underwriters Laboratories, Inc. (UL)

Building Materials Directory

1.03 QUALITY ASSURANCE

A. All materials for Work of this Section shall be from a single manufacturer.

B. Entities performing installation Work of this Section shall have not less than 5 years experience in installation of hollow metal doors, frames and associated fabrications.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Deliver hollow metal Work in cartons or crates to provide protection during transit and storage at the construction site. Inspect hollow metal Work upon delivery for damage. Field repair minor damage provided refinished items are equal in all respects to new Work and acceptable to the Engineer; otherwise, remove and replace items.

B. Store doors and frames at the construction site under cover. Place units on minimum 4 inch high wood blocking. Avoid use of non-vented plastic or canvas shelters which could create a humidity chamber. If cardboard wrapper on door becomes wet, remove carton immediately. Provide 1/4 inch spaces between stacked doors to promote air circulation.

1.05 SUBMITTALS

A. Submit the following in accordance with the requirements of "Shop Drawings, Catalog Cuts, and Samples" of Division 1 - GENERAL PROVISIONS:

1. Shop Drawings

Include details of each frame type, elevation of door design, types, hardware reinforcement, details of construction, anchorage details, and door schedules covering doors and frames using same opening reference number shown on the Contract Drawings.

2. Samples:

a. Door

One 1 foot 0 inch x 1 foot 0 inch corner section with hinge mortise and reinforcement showing internal construction.

b. Frame

One 1 foot 0 inch x 1 foot 0 inch corner section showing welded joint of head to jamb. Include hinge mortise, reinforcement and plaster guard in one rabbet.

c. Samples submitted shall be of the production type and represent the quality of Work to be installed.

B. Certifications

1. Evidence of installer qualifications as required by 1.03 of this Section.

2. Laboratory certification of prime paint, as required by 2.02 F. of this Section.

3. Certification of the following as required by 2.03 of this Section.

a. Door impact test
b. Oversize fire-rated door assemblies, if any
c. Sound transmission class (STC), if any
d. Insulating (U-value), if any

PART 2 - PRODUCTS

2.01 MANUFACTURERS

Subject to compliance with the requirements specified in this Section, provide products of one of the following, or approved equal:

A. Hollow Metal and Thermal Rated Doors, Frames and Panels

1. American Welding & Mfg. Co., Amweld Building Products Division, Niles, OH

2. Ceco Corporation, Oak Brook, IL

3. Curries Mfg., Inc., Mason City, IA

4. Pioneer Industries/Div. CORE Industries, Inc., Carlstadt, NJ

B. Sound Rated Door and Frame Assemblies

1. Allied Steel Products, Inc., Miami, FL.

2. Pioneer Industries/Div. CORE Industries, Inc.

3. Superior Fireproof Door, Inc., Scranton, PA.

2.02 MATERIALS

A. Provide the following, where shown on the Contract Drawings.

1. Interior Hollow Metal Doors, Panels and Frames

Commercial quality, cold rolled carbon steel conforming to ASTM A 366; or hot rolled, commercial quality carbon steel, pickled and oiled conforming to ASTM A 569.

2. Exterior Hollow Metal Doors, Panels and Frames

Commercial quality zinc-coated carbon steel conforming to ASTM A 526 with ASTM A 525, G 90, zinc coating, mill phosphatized.

3. Interior and Exterior Hollow Metal Doors, Panels and Frames - Stainless Steel

Commercial-quality stainless steel, AISI Type 302/304, complying with ASTM A 167, exposed finish No. 4 polish.

B. Insulating Material for Hollow Material Doors

Fiberglass, mineral wool, urethane, or similar type material, approved by the Engineer, resistant to fire, moist vermin, mildew and rot to meet requirements of 2.03 D., E. and F. of this Section. Provide required cores for fire-rated doors.

C. Supports and Anchors

Fabricate of not less than 16 gage sheet metal. For units to be built into exterior walls, galvanize after fabrication in conformance with ASTM A 153, Class B.

D. Inserts, Bolts and Fasteners

Manufacturer's standard units, except hot-dip galvanize those items to be built into exterior walls in conformance with ASTM A 153, Class C or D, as applicable.

E. Shop Applied Prime Paint

Baked-on-rust inhibiting prime paint capable of passing a 500 hour salt spray and 1000 hour humidity test in accordance with ASTM B 117 as certified by an independent laboratory and suitable as base for finish paint as specified in Section 09910 of these Specifications. Do not prime surfaces of stainless steel, if any.

2.03 CONSTRUCTION FEATURES

A. Provide hollow metal doors which have been pretested and certified by the manufacturer to conform to ASTM F 476 Door Impact Test, Grade 40, Table X5.1

B. Fire Rated Door Assemblies

Where fire-rated door assemblies are shown on the Contract Drawings, provide fire-rated door and frame assemblies that comply with NFPA No. 80; and have been tested, listed and labeled in accordance with ASTM E 152 by UL or other independent testing, inspection and labeling agency approved by the Engineer.

C. Oversize Fire-Rated Door Assemblies

For door assemblies required by the Contract Drawings to be fire-rated and exceeding sizes of tested assemblies, provide certificate of label construction from UL or other independent testing and inspection agency approved by the Engineer, indicating that door and frame assembly conforms to the requirements of design, materials and construction as established by individual listings for tested assemblies.

D. Temperature Rise Rating

For stairwell enclosure doors shown on the Contract Drawings, provide doors which have a temperature rise rating of 450 degrees F maximum in 30 minutes of fire exposure.

E. Sound Rated (Acoustical) Assemblies

Where acoustical doors are shown on the Contract Drawings, provide door and frame assemblies which have been fabricated as sound-reducing type, tested in accordance with ASTM E 90 and STC classified in accordance with ASTM E 413. Unless otherwise shown on the Contract Drawings, provide acoustical assemblies with sound ratings of STC 33 or better.

F. Thermal-Rate (Insulating) Assemblies

For exterior doors and other locations where shown on the Contract Drawings, provide hollow metal doors which have been fabricated as thermal insulating units and tested in accordance with ASTM C 236.

1. Unless otherwise shown on the Contract Drawings, provide unit "U-value" rating of 0.24 BTU/hr./sq. ft./degree F, or better.

2.04 FABRICATION

A. General

1. Fabricate hollow metal units rigid and free from defects, warps or buckles. Accurately form metal to sizes and profiles shown on the Contract Drawings. Factory fit and assemble units where possible. Identify Work that cannot be permanently factory assembled before shipment and provide required connector splines or plates to assure proper assembly at the construction site. Weld exposed joints continuously; grind and make smooth, flush and invisible. Do not use metallic filler to conceal manufacturing defects.

2. Fasteners

Unless otherwise shown on the Contract Drawings, provide countersunk flat Phillips or Jackson heads for exposed screws and bolts.

B. Finish Hardware Preparation

1. Prepare hollow metal doors and frames to receive mortised and concealed finish hardware including cutouts, reinforcing, drilling and tapping in accordance with approved finish hardware schedule and templates provided by hardware supplier. Comply with applicable requirements of ANSI A 115 series specifications.

2. Reinforce hollow metal units to receive surface-applied hardware. At the Contractor's option, drilling and tapping for surface-applied finish hardware may be done at the construction site.

3. Unless otherwise shown on the Contract Drawings, locate finish hardware in accordance with "Recommended Locations for Builders Hardware for Custom Steel Doors and Frames" published by DHI.

C. Shop Painting

1. Clean steel surfaces of mill scale, rust, oil, grease, dirt and other foreign materials before application of paint.

2. Apply pretreatment to cleaned metal surfaces using cold phosphate solution (SSPG-PT-2) or hot phosphate solution (SSPC-PT-4).

3. Apply shop coat of prime paint within time limits recommended by pretreatment manufacturer.

   a. Full immersion dip coat on frames.

   b. Smooth, even, full coverage spray coat on doors, panels and louvers to a uniform dry film thickness of not less than 2.0 mils.

D. Doors and Panels

1. Unless otherwise shown on the Contract Drawings, provide flush design doors 1 3/4 inch thick, fully welded seamless construction. Provide hollow metal panels, if any, of same materials, construction and finish as hollow metal doors.

   a. Interior Doors: Minimum 16 gage face sheets

   b. Exterior Doors: Minimum 14 gage face sheets

   c. For single-acting swing doors, bevel vertical edge 1/8 inch in 2 inches. For double-acting swing doors, round vertical meeting edge with 2 1/8 inch radius.

2. Reinforce inside of doors with continuous vertical formed steel sections not less than 22 gage spaced 6 inches o.c. Spot weld at not more then 5 inches o.c. to both face sheets.

3. Reinforce tops and bottoms of doors with 16 gage horizontal steel channels welded continuously to outer sheets. At exterior doors, close top and bottom edges with additional 16 gage steel channels as integral part of door construction to provide weather seal. Provide weep hole openings in door bottoms to permit escape of entrapped moisture.

4. Unless otherwise required for acoustical or thermal assemblies, provide filler of fiberboard, mineral wool board or other insulating material solidly packed to the full door height, to fill voids between inner core reinforcing members.

5. Fit non-fire-rated hollow metal doors in their respective frames, with the following clearances:

   a. Jambs and head: 1/8 inch
   b. Meeting edges, pairs of doors: 1/8 inch
   c. Bottom: 3/8 inch, where no threshold or carpet
   d. Bottom: 1/8 inch, at threshold or carpet

6. Fit fire-rated doors with clearances as specified in NFPA 80.

7. Stainless Steel Doors

Fabricate stainless steel doors of 2 outer stainless steel sheets gage as specified above, permanently bonded with contact adhesive to rigid internal steel core. Construct doors with smooth, flush surfaces without visible joints or seams on exposed faces or stile edges, except around glazed or louvered panel inserts. Provide #4 polish on exposed surfaces with vertical grain direction unless shown otherwise.

a. Provide internal core constructed of stainless steel stretcher-leveled steel sheets not less than 16 gage, vertically reinforced with stainless sheet sections not less than 22 gage, spaced 6 inches o.c., extending full height of door and spot welded to both face sheets at not more than 5 inches o.c. Continuous truss-form reinforcement of 28-gage stainless steel may be provided in lieu of spaced steel sections. Spot weld truss-form reinforcement 3 inches o.c. vertically and horizontally over entire core surface on both sides.

b. Reinforce tops and bottoms of doors with stainless steel 16 gage, horizontal channels, welded continuously to core faces. For exterior stainless steel doors, close top and bottom edges to provide weather seal.

E. Frames

1. Provide hollow metal frames for doors, transoms, side-lights and other openings as shown on the Contract Drawings.

2. Fabricate frames of full-welded unit construction with corners mitered, reinforced and continuously welded the full depth and width of frame. Terminate bottom of frames at finished floor surface. Knock-down type frames are not permitted.

a. Interior openings: Minimum 16 gage
b. Exterior openings: Minimum 14 gage
c. For openings over 4 feet wide, provide continuous 12 gage steel channel stiffener for full width of opening, welded to back of frame at head.

3. Provide removable spreader bar across bottom of frames, tack weld to jambs and mullions.

4. Except on interior doors listed in Section 08715 Appendix "A" Finish Hardware Schedule of these Specifications to receive acoustic, weather or smoke seals, drill stop in frame strike jamb to receive 3 silencers on single-door frames and drill frame head stop to receive 2 silencers on double-door frames. Install plastic plugs to keep holes clear until installation of silencers.

5. Provide 26 gage steel plaster guards welded to frame at back of hardware mortise on frames to be set in mortar or plaster construction.

6. Mullions and Transom Bars

   Provide closed or tubular mullions and transom bars where shown on the Contract Drawings. Reinforce joints between frame members with concealed clip angles of same metal thickness as frame. At removable units provide exposed fasteners; at fixed units, fasten by butt welding.

7. Form frames of stainless steel sheets with #4 polish for openings indicated to receive stainless steel doors, gage as specified above.

F. Frame Anchors

1. Floor Anchor

   Provide 14 gage galvanized steel sheet clip anchor welded to jambs, with 2 holes to receive fasteners and provision for 2 inch height and adjustment.

2. Jamb Anchors

   a. Masonry construction

      Adjustable, flat, corrugated or perforated, T-shaped to suit frame size, with leg not less than 2 inches wide by 10 inches long. Furnish minimum 3 anchors per jamb up to 7 feet - 6 inches high; 5 anchors for greater than 7 feet - 6 inches and up to 8 feet - 0 inches; over 8 feet - 0 inches one additional anchor for each 24 inches or part thereof.

b. Metal stud partitions

Insert type with notched clip to engage stud, welded to back of frames. Provide at least 4 anchors each jamb up to 7 feet - 6 inches height; 5 anchors for greater than 7 feet - 6 inches and up to 8 feet - 0 inches; over 8 feet - 0 inches one additional anchor for each 24 inches or part thereof.

c. In-place concrete or masonry

Anchor jambs with a minimum 3/8 inch concealed bolts into expansion shield or inserts at 6 inches from top and bottom and 26 inches o.c.

G. Finish Hardware Reinforcement

1. Reinforce doors and frames for required finish hardware as follows:

a. Hinges and Pivots

Steel plate 3/16 inch thick by 1 1/2 inch wide; 6 inches longer than hinge or pivot, secured by not less than 6 spot-welds.

b. Mortise Locksets and Dead Bolts: 14 gage steel sheet, secured with not less than 2 spot-welds.

c. Strike plate clips: Steel plate 3/16 inch thick by 1 1/2 inch wide by 3 inches long.

d. Flush Bolts: 12 gage steel sheet, secured with not less than 2 spot-welds.

e. Surface-Applied Closers and Coordinators

12 gage steel sheet, secured with not less than 6-spot welds. Provide reinforcement for surface closers on all doors and frames.

f. Concealed Closers

Removable steel access plate, 12 gage internal reinforcement of size and shape required, and enclosing housing to keep closer pocket free of mortar or other materials.

g. Push Plates and Grab Bars

16 gage steel sheet (except when sex screws are scheduled), secured with not less than 2 spot-welds.

h. Surface Panic Devices

14 gage sheet steel (except when sex screws are scheduled), secured with not less than 2 spot-welds.

H. Door Louvers

1. Unless otherwise shown on Contract Drawings, for interior doors provide sightproof, stationary type of inverted V-shaped blades formed of 18 gage cold-rolled steel. Prime paint after fabrication.

2. For fire-rated doors, provide tightly fitted, spring loaded automatic closing louvers with operable blades retained by fusible links. Rating label shall be the same as door units.

3. Mount louvers flush into doors without overlapping moldings on surface of door facing sheets.

I. Louvered Panels

1. Provide for installation in hollow metal frames where shown on the Contract Drawings.

2. Interior

Not less than 18 gage cold-rolled steel sheet, sightproof inverted V-shaped blades and U-shaped frames. Space blades not more than 3 inches o.c. with internal support as required. Assemble units by welding. Prime paint after fabrication.

3. Exterior

Not less than 16 gage galvanized steel sheet, stationary, weatherproof Z-shaped blades and U-shaped frames. Space blades not more than 1 1/2 inches o.c. with internal support as required. Provide removable 14 x 18 inch bronze wire mesh insect screens on interior side of frame with rigid formed galvanized steel frame surround.

J. Astragals

Install Z-shape on double-door active leaf 3/4 inch x 1 3/4 inch wide, 12 gage. Furnish with countersunk holes located at 12 inches o.c., fastened with flat head machine screws. Weld fill screw heads after installation and grind smooth. Tack welding may be substituted for machine screws.

K. Vision Panel

Minimum 20 gage glazing stops with butt corner joints, flush with face of door or frame , secured with countersunk tamperproof machine screws spaced at a maximum of 8 inches on centers on security side of door or frame.

PART 3 - EXECUTION

3.01 PREPARATION

Prior to frame installation, clean damaged areas of prime coat and apply touch-up of compatible air-drying primer at surfaces which will be concealed.

3.02 INSTALLATION

A. Install in accordance with approved shop drawings, manufacturer's data and as specified in this Section.

B. Provide anchorage devices where required for securing hollow metal frames to in-place construction. Use drilled-in anchorage devices and machine screws. Do not set floor anchors with powder-actuated fasteners.

C. Placing Frames

1. Set in position shown on the Contract Drawings, plumbed, aligned and braced until permanent anchors are set. After wall construction is complete, remove temporary braces and spreaders leaving surfaces smooth and undamaged.

2. Place frames at fire-rated openings in accordance with NFPA 80.

3. Make field splices in frames, if any, as detailed on approved shop drawings. Weld and finish to match shop Work.

D. Door Installation: Maintain door clearances in accordance with 2.04 D.5 and D.6 of this Section.

3.03 FIELD ADJUSTMENTS

A. Immediately after erection, sand smooth rusted or damaged areas of prime coat and apply touch-up of compatible air-drying primer.

B. Check and readjust operating finish hardware items. Remove and replace doors or frames which are warped, bowed or otherwise unacceptable to the Engineer.

C. Stainless Steel Touch-Up

Immediately after erection, smooth any abraded areas of stainless steel and polish to match undamaged finish.

END OF SECTION

N

SECTION 08340

OVERHEAD COILING GRILLES

PART 1 - GENERAL

1.01 SUMMARY

A. This Section specifies requirements for complete operating overhead coiling grille assemblies including curtains, guides counterbalance mechanisms, hardware, operators and installation acessories, as shown on the Contract Drawings.

B. Electrical connections for powered operators and accessories, if any, are specified in Division 16.

1.02 REFERENCES

A. The following is a listing of the publications referenced in this Section:

1. American Society for Testing and Materials (ASTM):

a.	ASTM A 446	Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process, Structural (Physical Quality)
b.	ASTM A 525	General Requirements for Steel Sheet, Zinc Coated (Galvanized) by the Hot Dip Process
c.	ASTM B 221	Aluminum - Alloy Extruded Bars, Rods, Wire, Shapes, and Tubes

2. Underwriters Laboratories (UL):

a.	UL 325	Door, Drapery, Gate Louver, and Window Operators and Systems

4. National Electrical Manufacturers Association (NEMA):

a.	ICS 1	General Standards for Industrial Control and Systems
b.	ICS 2	Industrial Control Devices, Controllers and Assemblies
c.	ICS 6	Enclosures for Industrial Controllers and Systems
d.	MG 1	Motors and Generators

1.03 QUALITY ASSURANCE

A. Furnish each overhead coiling grille as a complete unit produced by one manufacturer unless otherwise approved by the Engineer, including hardware, accessories, mounting and installation components.

B. *Inserts and Anchorages*

Furnish inserts and anchoring devices which must be set in concrete or built into masonry for installation of overhead coiling grille units. Provide setting drawings, templates, instructions and directions for installation of anchorage devices. Coordinate delivery with other Work to avoid delay.

C. See concrete and masonry Sections of these Specifications for installation of inserts and anchorage devices.

1.04 DESIGN AND PERFORMANCE REQUIREMENTS

A. Wind Loading: Design and reinforce overhead coiling grilles to withstand a 20 lb. per sq. ft. wind loading pressure unless otherwise shown on Contract Drawings.

1.05 SUBMITTALS

A. Submit the following in accordance with the Section of Division 1 GENERAL PROVISIONS entitled "Shop Drawings, Catalog Cuts, and Samples":

1. Product Data: Manufacturer's product data, roughing-in diagrams, and installation instructions for each type and size of overhead coiling grille. Provide operating instructions and maintenance information.

2. Shop Drawings: Shop drawings for components and installations, which are not fully dimensioned or detailed on manufacturer's data sheets.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Subject to compliance with requirements of this Section, provide products of one of the following, or approved equal:

Kinnear Div., Harsco Corp., Columbus, OH
Overhead Door Corp., Dallas, TX
J. G. Wilson Corp., Norfolk, VA

2.02 MATERIALS

A. Grille Curtain:

Fabricate grille curtain consisting of a network of 5/16" minimum diameter horizontal rods spaced approximately 2" o.c. Interconnect rods by vertical links approximately 5/8" wide, spaced approximately 9" apart and rotating on the rods, unless shown on the Contract Drawings. Provide one of the following types, where shown on the Contract Drawings:

1. Stainless Steel Grilles: AISI Type 302/304 with No. 4 finish, unless otherwise shown on the Contract Drawings:

2. Aluminum Grilles: ASTM B 221 with clear, satin anodized finish, unless shown otherwise on the Contract Drawings.

3. Steel Grilles: Hot dip or electro galvanized and phosphatized before fabrication. finish viht manufacturer's standard rust inhibitive primer.

B. Bottom Bar: Manufacturer's standard extruded shape or two angles, finished to match grille, as shown on the Contract Drawings.

C. For manually operated doors provide a replaceable gasket of flexible vinyl or neoprene between angles as a weather seal and cushion bumper.

D. End Locks: Continuous end links or other devices at ends of rods, locking and retaining grille curtain in guides against excessive pressures, maintaining curtain alignment and preventing lateral movement.

E. Guides: Manufacturer's standard extruded aluminum shape having curtain groove with return lips or bars to retain curtain. Furnish pile strips, rigid vinyl liner, or other nonmetallic inserts to prevent metal-to-metal contact and minimize noise of travel. Furnish removable stops on guides to prevent overtravel of curtain.

F. Counterbalance grille by means of adjustable steel helical torsion spring, mounted around a steel shaft and mounted in a spring barrel and connected to grille curtain with required barrel rings. Use grease-sealed bearings or self-lubricating graphite bearings for rotating members.

G. Counterbalance Barrel: Fabricate spring barrel of hot-formed structural quality carbon steel, welded or seamless pipe, of sufficient diameter and wall thickness to support roll-up curtain without distortion and limit barrel defection to not more than 0.03" per ft. of span under full load.

H. Provide spring balance of one or more oil-tempered, heat-treated steel helical torsion springs. Size springs to counterbalance weight of curtain, with uniform adjustment accessible from outside barrel. Provide cast steel barrel plugs to secure ends of springs to barrel and shaft.

I. Fabricate torsion rod for counterbalance shaft of case-hardened steel, of required size to hold fixed spring ends and carry torsional load.

J. Brackets: Provide mounting brackets of manufacturer's standard design, either cast iron or cold-rolled steel plate with bell mouth guide groove for curtain.

K. Hood: Form to entirely enclose coiled curtain and operating mechanism at opening head. Contour to suit end brackets to which hood is attached. Roll and reinforce top and bottom edges for stiffness. Provide closed ends for surface-mounted hoods, and any portion of between-jamb mounting projecting beyond wall face. Provide intermediate support brackets as required to prevent sag.

1. Fabricate hoods for steel grilles of not less than 24 gage hot-dip galvanized steel sheet with G 90 zinc coating, complying with ASTM A 525. Phosphate treat before fabrication.

2.03 CONSTRUCTION FEATURES

A. Provide manual operators as shown on Contract Drawings except where electric door operators are otherwise shown:

1. Manual Push-Up Operation: For grille not exceeding 80 sq. ft. area, provide counterbalance mechanism so that required lift or pull for grille operation does not exceed 25 lbs. Adjust operating mechanism so that curtain can be easily stopped at any point in its travel and to remain in position until movement is resumed. Furnish pull down chain, strap, or hook. For grilles 8 feet high and over, furnish pull down pole with hook.

a. Provide lifting handle, same material as grille curtain, and slide bolt lock on inside bottom bar.

2. Chain Hoist Operator: Provide manual chain hoist operator consisting of endless steel hand chain, chain pocket wheel and guard, and geared reduction unit with maximum 35 lbs. pull for grille operation. Design chain hoist with self-locking mechanism allowing curtain to be stopped at any point in its travel and to remain in position until movement is resumed. Furnish alloy steel hand chain with chain holder secured to operator guide.

3. Crank Hoist Operator: Provide crank hoist operator consisting of crank and crank gear box, steel crank drive shaft and gear reduction unit. Size gear to require no more than 25-lbs. effort to turn crank. Fabricate gear box to completely enclose operating mechanism and be oil-tight. Design unit so that curtain may be stopped at any point in its travel and to remain in position until movement is resumed. Provide manufacturer's standard removable operating arm for each crank-gear unit.

B. Electric Grille Operators:

1. Where shown on Contract Drawings, provide electric grille operator assembly conforming to NEMA Standards ICS1, ICS2, ICS6 and MG1; and approved in accordance with UL 325, of size and capacity recommended and provided by grille manufacturer; complete with electric motor and factory-prewired motor controls, gear reduction unit, solenoid operated brake, remote control stations, control devices, conduit and wiring from controls to motor and central stations in accordance with Division 16, and accessories required for proper operation.

2. Provide hand-operated disconnect or a mechanism for automatically engaging a sprocket and chain operator and releasing brake for emergency manual operation. Mount disconnect and operator so they are accessible from floor level. Include interlock device to automatically prevent motor from operating when emergency operator is engaged.

3. Provide operator that will enable motor to be removed without disturbing limit-switch adjustment and without affecting emergency auxiliary operator.

4. Grille Operator Type: Provide wall or bracket-mounted door operator units conforming to NEMA requirements, consisting of electric motor, worm gear drive from motor to reduction gear box, chain or worm gear drive from reduction box to gear wheel mounted on counterbalance shaft, and a disconnect-release for manual operation.

5. Electric Motors: High-starting torque, reversible, constant duty, class A insulated electric motors with overload protection, sized to move door in either direction, from any position, at not less than 2/3 foot nor more than 1 foot per second.

   a. Unless otherwise shown on Contract Drawings provide open-drip proof type motor and controller with NEMA Type I enclosure.

b. Where shown on Contract Drawings provide totally enclosed, nonventilated type motors, fitted with plugged drain, and controller with NEMA Type 4 enclosure.

6. Remote Control Station: Provide momentary-contact, 3-button control station with push button controls labeled "open", "close" and "stop".

a. Interior units, full-guarded, surface-mounted heavy-duty, with general purpose NEMA Type 1 enclosure.

b. Exterior units, full-guarded type, standard duty, surface-mounted, weatherproof type, NEMA Type 4 enclosure, key-operated.

7. Automatic Reversing Control: Furnish each grille with electrically actuated automatic safety switch, extending full width of grille bottom, and located within neoprene astragal mounted to bottom grille rail. Contact with switch before fully closing will immediately stop downward travel and reverse direction to fully opened position. Connect to control circuit through retracting safety cord and reel, or self-coiling cable.

2.04 SHOP PAINTING

A. Shop clean and prime ferrous metal and galvanized surfaces, exposed and unexposed, except faying and lubricated surfaces, with door manufacturer's standard rust inhibitive primer.

PART 3 - EXECUTION

3.01 PREPARATION

A. Ensure that concrete and masonry anchors, if any, are properly installed, in accordance with approved shop drawings before commencing grille installation.

3.02 INSTALLATION

A. Install grille and operating equipment complete with necessary hardware, jamb and head mold strips, anchors, inserts hangers, and equipment supports in accordance with approved shop drawings, manufacturer's instruction, and as specified herein.

B. Install electrically operated doors in accordance with NFPA 70 and 72E.

C. Field paint grilles, where shown on the Contract Drawings to be painted, in accordance with Section of these Specifications on painting.

3.03 FIELD TESTS

A. Upon completion of installation including associated Work by other trades, lubricate, test and adjust doors to operate easily, free from warp, twist or distortion.

END OF SECTION

SECTION 08715

FINISH HARDWARE

PART 1 - GENERAL

1.01 SUMMARY

A. This Section specifies requirements for finish hardware for doors scheduled in Appendix "A" to this Section.

B. Establish keying, furnish keys and key control system in accordance with Keying Appendix "B" to this Section:

C. If required by Appendix "C" to this Section, furnish extra stock and specialized tools and maintenance instructions.

1.02 REFERENCES

The following is a listing of the publications referenced in this Section:

American National Standards Institute, Inc. (ANSI)/Builders Hardware Manufacturers Association, Inc. (BHMA)

A 156.1	-	Butts and Hinges
A 156.2	-	Locks and Lock Trim
A 156.3	-	Exit Devices
A 156.4	-	Door Controls - Closers
A 156.5	-	Auxiliary Locks
A 156.7	-	Template Hinge Dimensions
A 156.8	-	Door Controls - Overhead Holders
A 156.13	-	Mortise Locks and Latches
A 156.14	-	Sliding and Folding Door Hardware
A 156.18	-	Materials and Finishes
A 117.1	-	Providing Accessibility and Usability of Physically Handicapped People

Underwriters Laboratories Inc. (UL)

Building Materials Directory

UL 228 - "Door Closers-Holders, With or Without Integral Smoke Detectors"

UL 437 - "Key Locks"

National Fire Protection Association (NFPA)

Standard No. 80 "Fire Doors and Windows"

Door and Hardware Institute (DHI)

"Recommended Locations for Builders Hardware for Custom Steel Doors and Frames"

1.03 DESIGN AND PERFORMANCE REQUIREMENTS

A. Fire Rated Openings

Provide hardware for fire-rated openings in compliance with NFPA No. 80 which has been tested and listed by UL Building Materials Directory or other nationally recognized independent testing, inspection and labeling agencies acceptable to the Engineer.

B. Detectable Warnings

Provide doors shown on the Contract Drawings leading to potential hazardous locations such as boiler rooms and loading docks that are accessible to the public, with textured surface hardware conforming to requirements of ANSI A 117.1, and as scheduled in Appendix "A" to this Section.

C. Closers and Holders

Conform to requirements of ANSI A 156.4, Grade 1, and ANSI A 156.8 respectively.

1. Where door(s) shown on the Contract Drawings are required to be accessible to the physically handicapped and are scheduled in Appendix "A" to this Section to receive manual closer(s), provide adjustable unit(s) complying with ANSI A 117.1 provisions for door opening force and delayed action.

D. Furnish and mount electro-magnetic door holder(s) where shown on the Contract Drawings or scheduled in Appendix "A" to this Section. Electrical connections for such item(s), if any, are specified in Division 16 Section(s) of these Specifications.

1. Provide integral smoke detector device in combination door closers and holders complying with UL 228.

E. Exit Devices

Conform to requirements of ANSI A 156.3 Grade 1. Where emergency exit devices are required on fire rated door(s), provide exit devices available as a complete series, listed in UL "Accident Equipment List - Panic Hardware" and bearing the designation "Fire Exit Hardware".

F. Locks

Conform to the following ANSI Standards, provide 5/8 inch minimum throw on pairs of non-fire-rated doors and 3/4 inch minimum throw on pairs of fire-rated doors:

1. Mortise Locks and Latches: A 156.13, Grade 1

2. Cylindrical Locks and Latches: A 156.2, Grade 1

G. Cylinders

Conform to the requirements of ANSI A 156.5 Grade 1, UL listed, and tested for drill and pick resistance requirements of UL 437.

H. Strikes

Manufacturer's standard wrought box strike for each latch or lock bolt, with curved lip extended to protect frame, finished to match hardware set. Provide dust-proof strikes for foot-bolts, except where threshold provides non-recessed strike for bolt.

I. Sliding and Folding Door Hardware: Conform to ANSI A 156.14.

J. Template Hinges

Conform to ANSI A 156.1 and A 156.7. All hinges shall be full-mortise type, ball-bearing function, unless otherwise indicated on Hardware Schedule Appendix "A" to this Section.

K. Materials and Finish

Conform to ANSI A 156.18, do not furnish products of Type O "optional" materials or forming methods. Provide matching finishes for hardware units at each door or opening to the greatest extent possible. Reduce color and texture differences as much as commercially possible.

1.04 QUALITY ASSURANCE

A. The entity performing Work of this Section shall have a minimum of 5 years of experience involving quantities and complexities at least equal to those required for the work of this Section, and shall employ an architectural hardware consultant who shall be available for consultation at the construction site if requested by the Engineer.

B. Provide instruction for the management of the key control system, if any, as required by 1.04 of Appendix "B" to this Section.

C. Manufacturers for various products are listed in Finish Hardware Schedule Appendix "A" to this Section. Except as otherwise shown on Appendix "A", products of equivalent quality, design and function by other manufacturers may be used subject to approval of the Engineer in accordance with 1.06 A hereof.

1. Provide each type of hardware (latch and lock sets, mortise locks, mortise cylinders, hinges, closers, or other items) from a single manufacturer.

2. Where finish hardware provided as Work of this Section is to be installed within an existing Authority facility, provide such items from the same manufacturer as presently installed unless otherwise shown on Appendix "A" to this Section.

1.05 DELIVERY, STORAGE AND HANDLING

A. Tag or package each item separately, with identification related hardware schedule required under 1.06 B.1.a of this Section set number. Include manufacturer's basic installation instructions with each item or package.

B. Pack and deliver all locks and cylinders less keys.

C. Provide secure lock-up for hardware delivered to the construction site, but not yet installed. Provide controlled handling and installation of hardware until issuance of the Certificate of Final Completion.

D. Deliver keys as required by Appendix "B" to this Section.

E. If extra stock is requried by Appendix "C" to this Section, deliver materials to the Engineer in accordance with 1.05A and B hereof; and deliver keys in accordance with Appendix "B" hereof.

1.06 SUBMITTALS

A. Submit a finish hardware data sheet listing manufacturers of finish hardware to be furnished and installed as Work of this Section in accordance with the requirements "Inspections and Rejections" of Division 1 - GENERAL PROVISIONS.

B. Submit the following in accordance with the requirements of "Shop Drawings, Catalog Cuts, and Samples" of Division 1 - GENERAL PROVISIONS:

1. Product Data

a. Hardware Schedule

Based on the manufacturers approved in accordance with 1.06 A of this Section. Organize schedule by hardware sets and include the following:

(1) Name and manufacturer of each item.

(2) Type, style function, size and finish of each item.

(3) Location of hardware set cross-referenced to Contract Drawing door opening numbers.

(4) Door and frame sizes, and materials.

(5) Wiring diagrams of electronic hardware items.

(6) Explanation of all abbreviations, codes and symbols contained in schedule.

(7) UL label designation.

b. Keying Schedule shall be in accordance with 1.02 of Appendix "B" to this Section.

2. Samples

Concurrent with submittal of Appendix "A" to this Section, submit to the Engineer one sample of each type of hardware unit, tagged with full description. Samples shall be retained by and become the property of the Authority.

C. Submit templates to each fabricator of doors and frames as required for preparation to receive hardware. Submit to the Engineer notification of such transmittals to door fabricator(s).

D. If required by Appendix "C" to this Section submit extra stock and one complete set of specialized tools for maintenance to the Engineer in accordance with 1.05 E of this Section.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Finish hardware manufacturers, or approved equal, are listed in Appendix "A" to this Section.

B. Key control system manufacturers, if required by 1.04 of Appendix "B" to this Section, as follows:

1. Best Lock Corp., Indianapolis, IN
2. Telke Inc., Glen Riddle, PA
3. Key Control Systems Inc., Bechtelsville, PA

2.02 MATERIALS

Provide hardware conforming to Appendix "A" to this Section and requirements of 1.03 of this Section.

2.03 CONSTRUCTION FEATURES

A. Provide hardware for machine screw installation. Do not provide hardware prepared for self-tapping sheet metal screws, unless specifically scheduled otherwise in Appendix "A" to this Section.

B. Furnish screws for installation with each hardware item. Provide Phillips flat-head screws unless specifically scheduled otherwise in Appendix "A" to this Section. Finish exposed screws (exposed under any condition) to match hardware finish or, if exposed in surfaces of other Work, to match finish of such other Work, including "Prepared for Paint" on surfaces to receive paint finish.

C. Provide concealed fasteners for hardware units which are exposed when door is closed. Do not use through bolts; provide sex screw fastener.

D. Hinges

Provide stainless steel pins on non-ferrous hinges, steel pins on steel hinges; non-removable at exterior and outswinging corridor doors, non-rising for interior non-security exposure, flat button with matching plugs.

E. Closers

1. Provide parallel arms, unless otherwise scheduled in Appendix "A" to this Section.

2. No corner mounting brackets permitted.

3. Mount closers on interior of building, and within stairwells.

4. Where parallel arm closers are scheduled at exterior doors in Appendix "A" to this Section, provide units one size larger than manufacturer's recommendations for standard arm units.

F. Provide coordinator device for pairs of doors equipped with closers and astragal, prepared for vertical rod exit device.

G. Provide metal threshold unit of type, size and profile as shown on the Contract Drawings or scheduled on Appendix "A" to this Section. Include butyl-rubber or polyisobutylene mastic sealant for exterior doors.

H. Provide resilient silencers for all interior metal door frames, 3 per single door frame, 2 per double door frame, unless acoustic or smoke seal is scheduled on Appendix "A" to this Section.

I. Provide protection plates where scheduled on Appendix "A" to this Section, sized as follows:

1. Armor plates: 36 inches high

2. Mop plates: 4 inches high

3. Kick plates: 8 inches high

4. Kick plates for barrier free doors: 16 inches high

5. Width

1 1/2 inches less than door opening on door stop side; 1/2 inch less than door opening opposite stop side.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install each hardware item in compliance with the manufacturer's instructions. Unless otherwise shown on the Contract Drawings, locate in accordance with DHI "Recommended Locations for Builders Hardware for Custom Steel Doors and Frames".

B. Coordinate installation, removal, storage and reinstallation of items with finishing Work specified in Division 9 Section(s) of these Specifications.

C. Set hardware units level, plumb and true to line and location.

D. Drill and countersink units which are not factory prepared for anchorage fasteners.

E. Set exterior door threshold in full bed of mastic sealant to completely exclude moisture.

3.02 ADJUSTMENTS

A. Check and adjust each hardware item and each door. Ensure proper operation. Replace operating units which cannot be adjusted to operate freely and smoothly.

B. Adjust door control devices to compensate for operation of heating and ventilating equipment.

C. Clean hardware and adjacent surfaces.

END OF SECTION

SECTION 08715

APPENDIX "A"

FINISH HARDWARE SCHEDULE

The following schedule contains a listing of hardware for each door (and roof hatch and locker, if any) by set number which corresponds with hardware set number shown on the Contract Drawings.

* Denotes manufacturers scheduled for Work of this Section, or approved equal.

** Denotes manufacturers scheduled for Work of this Section, with no substitution permitted.

[Insert * or ** adjacent to manufacturers below as appropriate for the Contract]

ITEM	MANUFACTURER	SYMBOL
Locks/Latches	Best	B
	Corbin	C
	Yale	Y
Cylinders	Best	B
	Corbin	C
	Yale	Y
Butts/Hinges	Hager	H
	McKinney	MC
	Stanley	ST
Exit/Panic Devices	Corbin	C
	Yale	Y
	Von Duprin	V
Door Bolts	Builders Brass Works	BW
	Ives	I
	Stanley	ST
Overhead Closers	Corbin	C
	LCN	LCN
	Yale	Y
Smoke Activated Closers	Corbin	C
	Dorma	D
	Rixon Firemark	RF
Floor Closers	Door O Matic	DM
	Dorma	D
	Rixon Firemark	RF

Overhead Stop	Corbin	C
	Glynn-Johnson	GJ
	Rixon-Firemark	RF
Door Striping, Drop Seal & Threshold	A.J. May	M
	Pemko	P
	Zero	Z
Silencers	Builders Brass Works	BW
	Ives	I
	Trimco	T
Push/Pull Units and Protection Plates	Builders Brass Works	BW
	Tremco	T
	Quality Hardware Co.	QH
Sliding/Bi-Fold Hardware Sets	Grant	GR
	Lawrence	LA
	Stanley	ST
Door Trim/Stops	Builders Brass Works	BW
	Glynn-Johnson	GJ
	Ives	I

HARDWARE SETS

[Fill in below and add or delete set numbers as appropriate for Contract]

HW1 (For Each Door No.)
[For Exterior Entrance]

HW2 (For Each Door No.)
[Stair Exit]

HW3 (For Each Door No.)
[Interior with Lock and Door Closer]

HW4 (For Each Door No.)
[Interior with Latch and Door Closer]

HW5 (For Each Door No.)
[Interior with Lock]

HW6 (For Each Door No.)
[Interior with Latch]

HW7 (For Each Door No.)
[Interior with Push-Pull and Door Closer]

HW8 (For Each Door No.)
[Interior with Push-Pull, Door Closer and Deadlock]

HW9 (For Each Door No.) [Roof Hatch]
[Interior or Exterior Door, or roof Hatch with Padlock]

Floor Closers	Rixson Firemark	RF
	Dorma	D
	Door O Matic	DM
Overhead Stop	Rixson-Firemark	RF
	Corbin	C
	Glynn-Johnson	GJ
Door Striping, Drop Seal & Threshold	A.J. May	M
	Pemko	P
	Zero	Z
Silencers	Builders Brass Works	BW
	Ives	I
	Trimco	T
Push/Pull Units and Protection Plates	Builders Brass Works	BW
	Trimco	T
	Quality Hardware Co.	QH
Sliding/Bi-Fold Hardware Sets	Grant	GR
	Lawrence	LA
	Stanley	ST
Door Trim/Stops	Builders Brass Works	BW
	Glynn-Johnson	GJ
	Ives	I

HARDWARE SETS

HW SET #1 (Door #1)

Each door to have:

4 Hinges	FBB 199 4.5 x 4.5	US32
1 Exit Device	90047 NL-F	US32
1 Cylinder		
1 Door Closer	CSPH 2220M	AL
3 Silencers		

HW SET # 2 (Door # 2)

Each door to have:

4 Hinges	FBB 199 4.5 x 4.5	US32
1 Exit Device	90047 NL-F	US32
1 Cylinder		
1 Door Closer	CSPH 2220M	AL
3 Silencers		

HW SET # 3 (Door # 3)

Each pair to have:

8 Hinges	FBB 199 4.5 x 4.5	US32
1 Exit Device	90047 NL-F	US32
1 Exit Device	90047 DT-F	US32
2 Door Closers	PH 2220M PA	AL
2 Wall Magnets	FM 998	AL
Silencers		

SECTION 08715

APPENDIX "B"

KEYING

1.01 CONSTRUCTION KEY SYSTEM

A. Equip locks with cylinders for interchangeable core pin tumbler inserts.

1. Furnish and install temporary cores for the construction period. Remove cores when directed by the Engineer.

2. Furnish and install final cores.

1.02 KEYING SYSTEM

[Add or delete from below as appropriate]

A. General: Meet with the Engineer and the facility manager to finalize keying requirements and obtain final instructions in writing.

1. Submit detailed keying schedule as required by 1.06C.2 of this Specification Section to indicate final keying of locks. Provide the following:

a. Keying system schematic diagram, and floor plan(s) with corresponding key symbols indicated for each door.

b. Copy of final keying schedule as transmitted to lock manufacturer.

c. When keying is an extension of an existing system, include all references and registry numbers of existing keying.

B. Provide integrated master keying system, with the existing system.

C. Mark the keying symbol on key bow only.

1.03 KEYS

A. Key Material: Nickel silver, without substitution.

[Fill in below as appropriate for contract.]

B. If a construction key system is required by 1.01A hereof, deliver 5 construction keys and the temporary cores from the lock manufacturer to the Engineer via registered mail. Schedule mail delivery to provide key and core receipt to the Engineer prior to construction site delivery of finish hardware items.

C. Key Quantity: Deliver the following keys from the lock manufacturer to the Engineer via registered mail.

1. Prior to construction site delivery of finish hardware items:

a. 3 change keys

b. 5 of each masterkey, grandmaster key or great-grandmaster key.

2. Prior to issuance of the Certificate of Final Completion, 5 control keys for initial construction.

1.04 KEY CONTROL SYSTEM

A. A key control system is not required.

B. Instruction at the construction site by a direct representative of the key control system manufacturer is not required.

END OF APPENDIX "B"

SECTION 08715

APPENDIX "C"

MAINTENANCE PROVISIONS

1.01 EXTRA STOCK

A. Extra stock for finish hardware items is not required.

B. Specialized tools are not required.

END OF APPENDIX "C"

DIVISION 9

SECTION 09250

GYPSUM DRYWALL

PART 1 - GENERAL

1.01 SUMMARY

This Section specifies requirements for gypsum drywall partitions and furring.

1.02 REFERENCES

The following is a listing of the publications referenced in this Section:

American Society for Testing and Materials (ASTM)

ASTM A 525	General Requirements for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process
ASTM C 36	Gypsum Wallboard
ASTM C 442	Gypsum Backing Board
ASTM C 475	Joint Treatment Materials for Gypsum Wallboard Construction
ASTM C 630	Water-Resistant Gypsum Backing Board
ASTM C 645	Non-Load (Axial) Bearing Steel Studs, Runners (Track), and Rigid Furring Channels for Screw Application of Gypsum Board
ASTM C 665	Mineral Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing
ASTM C 754	Installation of Steel Framing Members to Receive Screw-Attached Gypsum Wallboard, Backing Board, or Water-Resistant Backing Board
ASTM C 840	Application and Finishing of Gypsum Board
ASTM C 919	Practices for Use of Sealants in Acoustical Applications
ASTM C 1002	Steel Drill Screws for the Application of Gypsum Board

ASTM E 96 — Test Method for Water Vapor Transmission of Materials

ASTM E 119 — Method of Fire Tests of Building Construction and Materials

Gypsum Association

GA-216 — Recommended Specifications for the Application and Finishing of Gypsum Board

GA-505 — Gypsum Board - Glossary of Terminology

GA-600 — Fire Resistance Design Manual

Underwriters Laboratories Inc. (UL)

Fire Resistance Directory

1.03 DESIGN AND PERFORMANCE REQUIREMENTS

A. Fire-Resistance Ratings

Where gypsum drywall systems with fire-resistance ratings are shown on the Contract Drawings, provide materials and installations which are identical with those of applicable assemblies tested per ASTM E 119 by fire testing laboratories acceptable to the Engineer.

1. Provide fire-resistance rated assemblies identical to those indicated by reference to GA File Nos. in GA-600 Fire Resistance Design Manual or to design designations in UL Fire Resistance Directory or in listing of other testing and inspecting agencies acceptable to the Engineer.

B. Gypsum Board Terminology Standard: GA-505 by Gypsum Association.

C. Sound Transmission Ratings

Where gypsum drywall systems with sound transmission ratings are shown on the Contract Drawings, provide assemblies identical to those indicated by reference to GA File Nos. in GA-600 Fire Resistance Design Manual.

1.04 ENVIRONMENTAL REQUIREMENTS

A. General

Comply with requirements of referenced gypsum board application standards and recommendations of gypsum board manufacturer, for environmental conditions before, during and after application of gypsum board.

B. Cold Weather Protection

When ambient outdoor temperatures are below 55 degrees F, maintain continuous, uniform, building temperature of not less than 55 degrees F for a minimum period of 48 hours prior to, during and following the application of gypsum board and joint treatment materials for bonding of adhesive.

C. Ventilation

Ventilate building spaces as required to remove water in excess of that required for drying of joint treatment material immediately after its application. Avoid drafts during dry, hot weather to prevent too-rapid drying.

1.05 QUALITY ASSURANCE

Single-Source Responsibility

Obtain gypsum boards from a single manufacturer. Obtain ancillary materials from manufacturer recommended by the manufacturer of gypsum boards.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in original packages, containers or bundles bearing brand name and identification of manufacturer.

B. Store materials inside, under cover and in a manner to keep them dry, protected from weather, direct sunlight, surface contamination, corrosion and damage from construction traffic and other causes. Neatly stack gypsum boards flat to prevent sagging.

C. Handle gypsum boards to prevent damage to edges, ends or surfaces. Protect metal corner beads and trim from being bent or damaged.

1.07 SUBMITTALS

A. Submit the following in accordance with the requirements of "Shop Drawings, Catalog Cuts, and Samples" of Division 1 - GENERAL PROVISIONS:

1. Product Data

Submit manufacturer's product specifications and installation instructions for each gypsum drywall component, including test and other data as may be required to show compliance with the requirements of this Section.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Wall/Partition Support Materials, as listed below, where shown on the Contract Drawings:

1. Studs

ASTM C 645; 0.0179 inch min. thickness of base metal, unless otherwise shown.

a. Depth of Section: 3 5/8 inch, unless otherwise shown.

b. Runners

Match studs; type recommended by stud manufacturer for floor and ceiling support of studs, and for vertical abutment of drywall Work at other work.

2. Furring Members

ASTM C 645; 0.0179 inch min. thickness of base metal, hat-shaped.

a. Where shown as "Resilient", provide manufacturer's special type designed to reduce sound transmission.

3. Z-Furring Members

Manufacturer's standard screw-type galvanized steel, Z-shaped; ASTM A 525, G 60; 0.0179 inch min. thickness of base metal; of depth shown; designed for mechanical attachment of insulation boards or blankets to concrete and masonry walls.

4. Fasteners for Furring Members

Type and size recommended by furring manufacturer for the substrate and application shown.

B. Gypsum Board, as listed below, where shown on the Contract Drawings:

1. Gypsum Wallboard

ASTM C 36; of types, edge configuration and thickness indicated below; in maximum lengths available to minimize end-to-end butt joints.

a. Type

Regular, unless otherwise shown. Type X for fire-resistant rated assemblies and where shown.

b. Edges

Tapered and featured (rounded or beveled) for prefilling.

c. Thickness: 5/8 inch, unless otherwise shown.

2. Gypsum Backing Board for Multi-Layer Applications

ASTM C 442 or, where backing board is not available from manufacturer, gypsum wallboard, ASTM C 36; of type, edge configuration and thickness indicated below; in maximum lengths available to minimize end-to-end joints.

a. Type

Regular, unless otherwise shown. Type X for fire-resistant rated assemblies and where shown.

b. Edges: Square, non-tapered; or V-tongue and groove.

c. Thickness: 5/8 inch, unless otherwise shown.

3. Water Resistant Backing Board

ASTM C 630; with tapered edges of type and thickness listed below; in maximum lengths available to minimize end-to-end butt joints.

a. Type

Regular, unless otherwise shown. Type X for fire-resistant rated assemblies and where shown.

b. Thickness: 5/8 inch, unless otherwise shown.

C. Trim Accessories, as listed below, where shown on the Contract Drawings:

1. General

Provide manufacturer's standard trim accessories formed of galvanized steel with either knurled and perforated or expanded flanges for nailing or stapling, and beaded for concealment of flanges in joint compound, unless otherwise shown. Provide corner beads, L-type edge trim-beads, U-type edge trim-beads, special L-kerf-type edge trim-beads, and one-piece control joint beads.

a. Semi-Finishing Type

Manufacturer's standard trim units which are not to be finished with joint compound.

b. Do not use plastic edge trim units.

D. Joint Treatment Materials, as listed below, where required for construction shown on the Contract Drawings:

1. Joint Compound

Two-component, ready-mixed, non-asbestos, vinyl-based type for interior use in accordance with ASTM C 475. Provide water-resistant type at water-resistant backing board.

2. Joint Tape: Paper reinforcing tape.

E. Miscellaneous Materials, as listed below, where required for construction shown on the Contract Drawings:

1. Laminating Adhesive

Special adhesive or joint compound specifically recommended for laminating gypsum boards.

2. Gypsum Board Screws: Comply with ASTM C 1002.

3. Concealed Acoustical Sealant

Nondrying, nonhardening, nonskinning, nonstaining, nonbleeding, gunnable sealant for concealed applications in accordance with ASTM C 919.

4. Exposed Acoustical Sealant

Nonoxidizing, skinnable, paintable, gunnable sealant for exposed applications in accordance with ASTM C 919.

5. Blanket Insulation

ASTM C 665, Type I, Mineral Fiber Blanket as follows:

a. For sound attenuation thickness as shown.

b. For thermal insulation, R value as shown.

6. Vapor Retarder

Polyethylene film, 4.0 mils thick, with a vapor rating of 0.20 perms in accordance with ASTM E 96.

7. Blocking: Two-inch thick, fire-retardant, treated wood.

PART 3 - EXECUTION

3.01 INSTALLATION

A. General

1. Metal Support Installation Standard: Comply with ASTM C 754.

2. Do not bridge building expansion joints with support system; frame both sides of joints with furring and other support as shown on the Contract Drawings.

B. Wall/Partition Support Systems Installation, as specified below, where required for construction shown on the Contract Drawings:

1. Install supplementary framing, blocking and bracing at terminations in the Work and to support fixtures, equipment services, heavy trim, grab bars, toilet accessories, furnishings, and similar work to comply with details shown or, if not otherwise shown, to comply with applicable printed recommendations of gypsum board manufacturer.

2. Isolate stud system from transfer of structural loading to system, both horizontally and vertically. Provide slip or cushioned type joints to attain lateral support and avoid axial loading.

3. Install runner tracks at floors, ceilings and structural walls and columns where gypsum drywall stud system abuts other work, unless as otherwise shown.

4. Extend partition stud systems through acoustical ceilings and elsewhere, as shown, to the structural support system above the ceiling.

5. Space studs 16 inches o.c., unless otherwise shown.

6. Frame door openings to comply with details shown, or if not shown, to comply with applicable printed recommendations of gypsum board manufacturer. Attach vertical studs at jambs with screws either directly to frames or to jamb anchor clips on door frames; install runner track section (for jack studs) at head and secure to jamb studs.

7. Extend vertical jamb studs through suspended ceilings and attach to underside of structural support system above, unless otherwise shown.

8. Frame openings other than door openings to comply with details shown or, if not shown, in the same manner as required for door openings. Install framing below sills of openings to match framing required above door heads.

9. Space wall furring members 16 inches o.c., unless otherwise shown.

10. Construct fire rated partitions, columns, beams, girders and trusses, when required, to meet or exceed the rating shown on the Contract Drawings. Comply with requirements of 1.04 A.1.

11. Construct sound rated partitions, when required, to meet or exceed the STC rating shown on the Contract Drawings. The assembly shall comply with requirements of 1.04 C.

C. Gypsum Board Installation, as specified below, where required for construction shown on the Contract Drawings:

1. Gypsum Board Application and Finishing Standards: ASTM C 840 and GA-126.

2. Locate exposed end-butt joints as far from center of walls as possible, and stagger not less than 1'-0" in alternate courses of board.

3. Install wall/partition boards vertically to avoid end-butt joints wherever possible. At stairwells and similar high walls, install boards horizontally with end joints staggered over studs.

4. Install exposed gypsum board with face side out. Do not install imperfect, damaged or damp boards. Butt boards together for a light contact at edges and ends with not more than 1/16" open space between boards. Do not force into place.

5. Locate either edge or end joints over supports, except in horizontal applications or where intermediate supports or gypsum board back-blocking is provided behind end joints. Position boards so that like edges abut, with tapered edges against tapered edges and mill-cut or field-cut ends against mill-cut or field-cut ends. Do not place tapered edges against cut edges or ends. Stagger vertical joints over different studs on opposite sides of partitions.

6. Attach gypsum board to supplementary framing and blocking provided for additional support at openings and cutouts.

7. Form control joints and expansion joints with space between edges of boards, prepared to receive trim accessories.

8. Cover both faces of steel stud partition framing with gypsum board in concealed spaces (above ceilings), except in chase walls which are braced internally.

   a. Except where concealed application is required for sound, fire, air or smoke ratings, coverage may be accomplished with scraps of not less than 8 sq. ft. area, but use of such scraps shall provide a minimum of 75 percent of full coverage.

9. Isolate perimeter of non-load-bearing drywall partitions at structural abutments. Provide 1/4 inch to 1/2 inch space and trim edge with J-type, semi-finishing edge trim. Seal joints with acoustical sealant.

10. Where sound-rated drywall Work is shown (STC rating), including double-layer Work and Work on resilient furring, seal the Work at perimeters, at control and expansion joints, at openings and penetrations with a continuous bead of acoustical sealant including a bead at both faces of partitions. Comply with ASTM C 919 and manufacturer's recommendations for location of beads, and close off sound-flanking paths around or through the Work, including sealing of partitions above acoustical ceilings.

11. Install vapor retarder where shown on the Contract Drawings and in accordance with the manufacturer's printed instructions. Seal joints by lapping and bonding with adhesive or vapor retarder tape. Seal tears and penetrations similarly.

D. Methods of Gypsum Drywall Application

1. Single-Layer Application

   On partitions/walls apply gypsum board vertically (parallel), unless otherwise shown on the Contract Drawings, and provide sheet lengths which will minimize end joints.

2. Double-Layer Application

   Install gypsum backing board for face layer.

   a. On partitions/walls, apply base layer and face layers vertically (parallel) with joints of base layer over supports and face layer joints offset at least 10 inches from base layer joints.

3. Single-Layer Fastening Methods

   Apply gypsum boards to supports with screws.

4. Double-Layer Fastening Methods

   Fasten base layer with screws and face layer with adhesive and supplementary fasteners.

E. Installation of Drywall Trim Accessories

1. Where feasible, use the same fasteners to anchor trim accessory flanges as are required to fasten gypsum board to the supports. Otherwise, fasten flanges by nailing or stapling in accordance with manufacturer's instructions and recommendations.

2. Install metal corner beads at external corners of drywall Work.

3. Install metal edge trim whenever edge of gypsum board would otherwise be exposed or semi-exposed. Provide type with face flange to receive joint compound except where semi-finished type is shown on the Contract Drawings. Install L-type trim where Work is tightly abutted to other Work, and install special kerf-type where other Work is kerfed to receive long leg of L-type trim. Install U-type trim where edge is exposed, revealed, gasketed, or sealant-filled (including expansion joints).

4. Install metal control joint (beaded-type) where shown on the Contract Drawings.

F. Finishing of Drywall

1. Apply compound treatment at gypsum board joints (both directions), flanges of trim accessories, penetrations, fastener heads, surface defects and elsewhere, as required to prepare Work for decoration. Prefill open joints and rounded or beveled edges, if any, using type of compound recommended by manufacturer.

   a. Apply joint tape at joints between gypsum boards using bedding joint compound, except where trim accessories are shown on the Contract Drawings.

   b. Apply topping joint compound in three coats (not including prefill of openings in base), and sand between last two coats and after last coat.

2. Partial Finishing

   Omit third coat and sanding on concealed drywall and on Work which is shown on the Contract Drawings to receive applied decorative finish other than paint.

3.02 PROTECTION

Provide protection and maintain conditions, in a manner suitable to the Engineer, which ensures that gypsum drywall Work shall be without damage or deterioration at time of issuance of the Certificate of Final Completion.

END OF SECTION

SECTION 09253

GYPSUM DRYWALL - INTERIOR CEILINGS AND SOFFITS

PART 1 - GENERAL

1.01 SUMMARY

This Section specifies requirements for interior gypsum drywall ceilings and soffits.

1.02 REFERENCES

The following is a listing of the publications referenced in this Section:

American Society for Testing and Materials (ASTM)

ASTM A 525	General Requirements for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process
ASTM A 641	Zinc-Coated (Galvanized) Carbon Steel Wire
ASTM C 36	Gypsum Wallboard
ASTM C 475	Joint Treatment Materials for Gypsum Wallboard Construction
ASTM C 645	Non-Load (Axial) Bearing Steel Studs, Runners (Track), and Rigid Furring Channels for Screw Application of Gypsum Board
ASTM C 665	Mineral Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing
ASTM C 754	Installation of Steel Framing Members to Receive Screw-Attached Gypsum Wallboard, Backing Board, or Water-Resistant Backing Board.
ASTM C 840	Application and Finishing of Gypsum Board
ASTM C 919	Practices for Use of Sealants in Acoustical Applications
ASTM C 1002	Steel Drill Screws for the Application of Gypsum Board

Gypsum Association

GA-216	Recommended Specifications for the Application and Finishing of Gypsum Board
GA-505	Gypsum Board Products - Glossary of Terminology
GA-600	Fire Resistance Design Manual

Underwriters Laboratories Inc. (UL)

Fire Resistance Directory

1.03 DESIGN AND PERFORMANCE REQUIREMENTS

A. For buildings located in New York City, metal support systems shall conform to the building code of the City of New York except that metal deck tabs shall not be used for top hanger attachment.

B. For buildings located in New Jersey - metal support systems shall conform to ASTM C 754 except for hangers and their top and bottom connections.

1. For the design and installation of hangers and their top and bottom connections, the hanger and its connections shall safely carry the total supported load plus 200 pounds.

C. Fire-Resistance Ratings

Where gypsum drywall systems with fire-resistance ratings are shown on the Contract Drawings, provide materials and installations which are identical with those of applicable assemblies tested per ASTM E 119 by fire testing laboratories acceptable to the Engineer.

1. Provide fire-resistance rated assemblies identical to those indicated by reference to GA File Nos. in GA-600 Fire Resistance Design Manual or to design designations in UL Fire Resistance Directory or in listing of other testing and inspecting agencies acceptable to the Engineer.

D. Gypsum Board Terminology Standard: GA-505 by Gypsum Association.

1.04 ENVIRONMENTAL REQUIREMENTS

General

A. Comply with requirements of referenced gypsum board application standards and recommendations of gypsum board manufacturer, for environmental conditions before, during and after application of gypsum board.

B. Cold Weather Protection

When ambient outdoor temperatures are below 55 degrees F, maintain continuous, uniform, building temperature of not less than 55 degrees F for a minimum period of 48 hours prior to, during and following application of gypsum board and joint treatment materials or bonding of adhesive.

C. Ventilation

Ventilate building spaces as required to remove water in excess of that required for drying of joint treatment material immediately after its application. Avoid drafts during dry, hot weather to prevent too rapid drying.

1.05 QUALITY ASSURANCE

Single-Source Responsibility

Obtain gypsum boards from a single manufacturer. Obtain ancillary materials from manufacturer recommended by the manufacturer of gypsum boards.

1.06 DELIVERY, STORAGE AND HANDLING

A. Deliver materials in original packages, containers or bundles bearing brand name and identification of manufacturer.

B. Store materials inside under cover and in a manner to keep them dry, protected from weather, direct sunlight, surface contamination, corrosion and damage from construction traffic and other causes. Neatly stack gypsum boards flat to prevent sagging.

C. Handle gypsum boards to prevent damage to edges, ends or surfaces. Protect metal corner beads and trim from being bent or damaged.

1.07 SUBMITTALS

Submit the following in accordance with the requirements of "Shop Drawings, Catalog Cuts, and Samples" of Division 1 - GENERAL PROVISIONS:

1. Product Data

Submit manufacturer's product specifications and installation instructions for each gypsum drywall component, including test and other data as may be required to show compliance with this Section.

2. Shop Drawings

Reflected ceiling plan(s), prepared for installation purposes, drawn accurately to 1/4 inch = 1 foot scale and coordinated with related mechanical, electrical, communication, fire suppression and other Work above, penetrating, or connected to ceiling or soffit. Show ceiling suspension members, method of anchorage to building structure and framing for supported items.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Direct Suspension Systems

Where such systems are shown on the Contract Drawings, provide products of one of the following, or approved equal:

1. Chicago Metallic Corp., Chicago, IL

   a. Non-Fire Rated: "640 Furring System"

   b. Fire Rated: "Fire-Front 650 Furring System"

2. Donn Corp., Westlake, OH

   Fire Rated and Non-Fire Rated: "Rigid X Drywall Suspension System"

3. National Rolling Mills, Paoli, PA

   Fire Rated and Non-Fire Rated: "DFR Series"

2.02 MATERIALS

A. Ceiling Support Materials and Systems For Suspended or Furred Ceilings

1. General

Size ceiling support components to comply with ASTM C 754, unless otherwise shown on the Contract Drawings or specified herein.

2. Hangers

Hangers for suspending ceilings and soffits shall be 1/4 inch diameter galvanized steel rods or 1/8 inch x 1 inch galvanized steel flat bars.

3. Hanger Anchorage Devices

Screws, clips, bolts, cast-in-place concrete inserts or other devices shall be appropriate for anchorage to the form of structural framing shown on the Contract Drawings and shall be suitable for the use intended as proven through standard construction practices or by certified test data acceptable to the Engineer.

4. Channels

Channels shall be cold-rolled steel, 0.0598 inch min. thickness of base metal (uncoated), allowable bending stress of 18,000 psi, protected with rust inhibitive paint or galvanizing complying with ASTM A 525 for G60 coating designation, and as follows:

a. Carrying Channels

1 1/2 inch deep x 7/16 inch wide flanges, 475 lbs. per 1000 feet painted, or 508 lbs. per 1000 - feet galvanized, as shown on the Contract Drawings.

5. Furring Members

ASTM C 645; 0.0179 inch min. thickness of base metal, hat-shaped.

a. Where shown on the Contract Drawings as "Resilient", provide manufacturer's special type designed to reduce sound transmission.

6. Furring Anchorages

ASTM A 641; 16-gage galvanized wire ties, manufacturer's standard wire-type clips, bolts, nails or screws as recommended by furring manufacturer and complying with ASTM C 754.

B. Gypsum Board

ASTM C 36; of types, edge configuration and thickness indicated below; in maximum lengths available to minimize end-to-end butt joints.

1. Type

   Regular, unless otherwise shown on the Contract Drawings. Type X for fire-resistant rated assemblies and where shown on the Contract Drawings.

2. Edges

   Tapered and featured (rounded or beveled) for prefilling.

3. Thickness: 1/2 inch, unless otherwise shown on the Contract Drawings.

C. Trim Accessories

Provide manufacturer's standard trim accessories of types shown on the Contract Drawings for drywall Work, formed of galvanized steel with either knurled and perforated or expanded flanges for nailing or stapling, and beaded for concealment of flanges in joint compound. Provide corner beads, L-type edge trim-beads, U-type edge trim-beads, special L-kerf-type edge trim-beads, and one-piece control joint beads.

D. Joint Treatment Materials

1. General

   ASTM C 475; type recommended by the manufacturer for the application shown on the Contract Drawings.

2. Joint Tape: Paper reinforcing tape.

3. Joint Compound

   Ready-mixed, vinyl-type for interior use. Two separate grades; one specifically for bedding tapes and filling depressions, and one for topping and sanding.

E. Miscellaneous Materials

1. General

   Provide auxiliary materials for gypsum drywall Work of the type and grade recommended by the manufacturer of the gypsum board.

2. Gypsum Board Screws: Comply with ASTM C 1002.

3. Concealed Acoustical Sealant

   Nondrying, nonhardening, nonskinning, nonstaining, nonbleeding, gunnable sealant for concealed applications per ASTM C 919.

4. Exposed Acoustical Sealant

Nonoxidizing, skinnable, paintable, gunnable sealant for exposed applications per ASTM C 919.

5. Blanket Insulation

Where shown on the Contract Drawings, ASTM C 665 as follows:

a. For sound attenuation, Type I, Class A, thickness as shown.

b. For thermal insulation, Type II, Class A, R value as shown.

PART 3 - EXECUTION

3.01 PREPARATION

A. Ceiling Anchorages

Coordinate Work with structural ceiling Work to ensure that inserts and other structural anchorage provisions have been installed to receive ceiling hangers.

1. Furnish concrete inserts and similar devices to be installed under other Sections well in advance of the time needed for installation.

3.02 INSTALLATION

A. General:

1. Metal Support Installation Standard

Comply with ASTM C 754, and as specified herein.

2. Do not bridge building expansion joints with support system; frame both sides of joints with furring or other support as shown on the Contract Drawings.

B. Install inserts and other structural anchorage members to receive ceiling hangers in a manner that develops their full strength and at spacings required to support ceiling.

C. Ceiling Support Suspension Systems

1. Secure hangers to structural support by connecting directly to structure where possible; otherwise, connect to inserts, clips or other anchorage devices or fasteners as shown on the Contract Drawings.

2. Space main runners 4 feet o.c. and space hangers 4 feet o.c. along runners, unless otherwise shown on the Contract Drawings.

3. Level main runners to a tolerance of 1/4 inch in 12 feet measured both lengthwise on each runner and transversely between parallel runners.

4. Wire-tie or clip furring members to main runners and to other structural supports as shown on the Contract Drawings.

5. Suspended Metal Support System

   Attach perimeter wall track, angle or trim wherever support system meets vertical surfaces. Mechanically join support members to each other and butt-cut to fit into vertical surface device.

6. Space furring member 16 inches o.c., unless otherwise shown on the Contract Drawings.

7. Install auxiliary framing at termination of drywall Work, and at openings for light fixtures and similar Work, as required for support of both the drywall construction and other Work shown on the Contract Drawings for support thereon.

D. Gypsum Board Installation Requirements

1. Gypsum board application and finishing standards: ASTM C 840 and GA 216.

2. Locate exposed end-butt joints as far from center of walls and ceilings as possible, and stagger not less than 1 foot in alternate courses of board.

3. Install ceiling boards in the direction and manner which shall minimize the number of end-butt joints.

4. Install exposed gypsum board with face side out. Do not install imperfect, damaged or damp boards. Butt boards together for a light contact at edges and ends with not more that 1/16 inch open space between boards. Do not force into place.

5. Locate either edge or end joints over supports or where intermediate supports or gypsum board back-blocking is provided behind end joints. Position boards so that like edges abut, with tapered edges against tapered edges and mill-cut or field-cut ends against mill-cut or field-cut ends.

6. Attach gypsum board to supplementary framing and blocking provided for additional support at openings and cutouts.

7. Form control joints and expansion joints with space between edges of boards, prepared to receive trim accessories.

8. Where sound-rated drywall Work is shown on the Contract Drawings, (STC rating), including Work on resilient furring, seal the Work at perimeters, at control and expansion joints, at openings and penetrations with a continuous bead of acoustical sealant including a bead at both faces of partitions. Comply with ASTM C 919 and manufacturer's recommendations for location of beads, and close off sound-flanking paths around or through the Work.

E. Application Methods

1. Install gypsum wallboard ceilings and soffits prior to wall/partition board application to the greatest extent possible.

2. Fasten gypsum wallboard ceilings and soffits with screws.

F. Trim Installation

1. General

Where feasible, use the same fasteners to anchor trim accessory flanges are required to fasten gypsum board to the supports. Otherwise, fasten flanges by nailing or stapling in accordance with manufacturer's instructions and recommendations.

2. Install metal corner beads at external corners of drywall Work.

3. Install metal edge trim whenever edge of gypsum board would otherwise be exposed or semi-exposed. Provide type with face flange to receive joint compound, except where semi-finished type is shown on the Contract Drawings. Install L-type trim where Work is tightly abutted to other Work, and install special kerf-type where other work is kerfed to receive long leg of L-type trim. Install U-type trim where edge is exposed, revealed, gasketed, or sealant-filled (including expansion joints).

4. Install metal control joint (beaded-type) where shown on the Contract Drawings.

G. Finishing

1. Apply compound treatment at gypsum board joints (both directions), flanges of trim accessories, penetrations, fastener heads, surface defects and elsewhere, as required to prepare Work for decoration. Prefill open joints and rounded or beveled edges, if any, using type of compound recommended by manufacturer.

   a. Apply joint tape at joints between gypsum boards using bedding joing compound, except where trim accessories are shown on the Contract Drawings.

   b. Apply topping joint compound in three coats (not including prefill of openings in base), and sand between last two coats and after last coat.

2. Refer to Division 9 Sections on painting, coatings and wall-coverings for decorative finishes to be applied to drywall Work.

3.03 PROTECTION

Provide protection and maintain conditions, in a manner suitable to the Engineer, which ensures that gypsum drywall Work shall be without damage or deterioration at time of issuance of the Certificate of Final Completion.

END OF SECTION

A

SECTION 09270

DRYWALL SHAFT SYSTEMS

PART 1 - GENERAL

1.01 SUMMARY

This Section specifies requirements for drywall shaft systems.

1.02 REFERENCES

The following is a listing of the publications referenced in this Section:

American Society for Testing and Materials (ASTM)

ASTM A 446 Steel Sheet, Zinc Coated (Galvanized) by the Hot-Dip Process, Structural (Physical) Quality

ASTM A 463 Steel Sheet, Cold Rolled, Aluminum Coated, Type I and Type II

ASTM A 525 General Requirements for Steel Sheet, Zinc Coated (Galvanized) by the Hot-Dip Process

ASTM C 36 Gypsum Wallboard

ASTM C 442 Gypsum Backing Board and Core Board

ASTM C 475 Joint Treat Materials for Gypsum Wallboard Construction

ASTM C 588 Gypsum Base for Veneer Plaster

ASTM C 630 Water Resistant Gypsum Backing Board

ASTM C 665 Mineral Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing

ASTM C 754 Installation of Steel Framing Members to Receive Screw-Attached Gypsum Wallboard, Backing Board, or Water Resistant Backing Board

ASTM C 840 Application and Finishing of Gypsum Board

ASTM C 919 Practice for Use of Sealants in Acoustical Applications

ASTM E 90 Method for Laboratory Measurement of Airborne-Sound Transmission Loss of Building Partitions

ASTM E 119 Method for Fire Tests of Building Construction and Materials

American Iron and Steel Institute (AISI)

Specification for Design of Cold-Formed Steel Structural Members

Gypsum Association (GA)

GA-216 Recommended Specifications for the Application and Finishing of Gypsum Board

GA-505 Gypsum Board Terminology Standard

GA-600 Fire Resistance Design Manual

Underwriter's Laboratories, Inc. (UL)

Fire Resistance Directory

1.03 DESIGN AND PERFORMANCE REQUIREMENTS

A. Fire-Resistance Ratings

Where drywall shaft systems with fire resistance ratings are shown on the Contract Drawings, provide materials and installations including elevator door and other framing, if any, which are identical with those of applicable assemblies tested in accordance with ASTM E 119 by fire testing laboratories acceptable to the Engineer.

1. Provide fire-resistance rated assemblies identical to those indicated by reference to GA-600 or in listing of UL Fire Resistance Directory.

B. Structural Performance Characteristics

Provide drywall shaft systems designed and tested by the manufacturer to withstand the following lateral design loadings (air pressures), applied transiently and cyclically for maximum heights of partitions required, within the following deflection limits.

1. Lateral Loading

As shown on the Contract Drawings or, if not shown, not less than 10 psf.

2. Deflection Limit

As shown on the Contract Drawings or, if not shown, not less than 1/240 of partition height.

C. Sound Transmission Class

Provide drywall shaft system design, tested by the manufacturer to achieve the minimum STC rating shown on the Contract Drawings, or if not shown, not less than 35 STC and in accordance with ASTM E 90.

1.04 ENVIRONMENTAL REQUIREMENTS

A. General

Comply with the requirements of referenced gypsum board application standards and recommendations of gypsum board manufacturer, for environmental conditions before, during and after application of gypsum board.

B. Cold Weather Protection

When ambient outdoor temperatures are below 55 degrees F, maintain continuous, uniform, building temperatures of not less than 55 degrees F for a minimum period of 48 hours prior to, during and following application of gypsum board and joint treatment materials or bonding of adhesive.

C. Ventilation

Ventilate building spaces as required to remove water in excess of that required for drying of joint treatment material immediately after its application. Avoid drafts during dry, hot weather to prevent too rapid drying.

1.05 QUALITY ASSURANCE

A. Gypsum Board Terminology Standard: GA-505 by Gypsum Association.

B. Single Source Responsibility

Obtain gypsum shaftwall products from manufacturers recommended by the prime manufacturer of gypsum shaftwall systems.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in the manufacturer's original, unopened packages, containers or bundles bearing brand name and identification of manufacturer or supplier.

B. Store materials inside under cover and in manner to keep them dry, protected from weather, direct sunlight, surface contamination, corrosion and damage from construction traffic and other causes. Neatly stack gypsum boards flat to prevent sagging.

C. Handle gypsum boards to prevent damage to edges, ends and surfaces. Protect metal corner beads and trim from being bent or damaged.

1.07 SUBMITTALS

A. Submit the manufacturer's product specifications and installation instructions for each gypsum drywall component, including test and other data as may be required to show compliance with the requirements of this Section and in accordance with the requirements of "Shop Drawings, Catalog Cuts, and Samples" of Division 1 - GENERAL PROVISIONS.

PART 2 - PRODUCTS

2.01 MATERIALS

A. General

Unless otherwise shown on the Contract Drawings, provide the manufacturer's standard materials specified in published product literature for the system and application required.

B. Metal Framing

Provide manufacturer's standard shapes for shaftwall construction; of profile, size and base metal thickness designed to comply with AISI "Specification for Design of Cold-Formed Steel Structural Members" for structural performance characteristics specified or shown on the Contract Drawings. Fabricate from steel sheet complying with ASTM A 446, Grade A or B, for structural performance of base metal; as well as with ASTM A 525, G60, for hot-dip galvanized products; and ASTM A 463 for aluminized products.

C. Gypsum Shaftwall Board

Provide manufacturer's standard gypsum backing board or coreboard designed for shaftwall construction and complying with ASTM C 442, Type X; with moisture-resistant paper facings, in maximum lengths available to eliminate or minimize end-to-end butt joints, and thicknesses shown on the Contract Drawings.

D. Gypsum Wallboard

As listed below and where shown on the Contract Drawings. Provide with tapered edges in maximum lengths available.

1. ASTM C 36, Type X, at dry room side areas.

2. ASTM C 630, Type X, at wet room side areas.

3. ASTM C 588, Type X, at plastered room side areas.

E. Gypsum Backing Board for Multilayer Applications

1. ASTM C 442 or where backing board is not available from manufacturer provide gypsum wallboard, ASTM C 36;

2. Type X where required for fire-resistance ratings, edge configuration as standard with manufacturer; and

3. Thickness as shown on the Contract Drawings.

F. Drywall Trim Accessories

Provide manufacturer's standard trim accessories of types shown on the Contract Drawings for drywall Work, formed of galvanized steel, with either knurled and perforated or expanded flanges for nailing or stapling, and beaded for concealment of flanges in joint compound. Provide corner beads, L-type edge trim-beads, U-type edge trim-beads, special L-kerf-edge trim-beads, and one-piece control joint beads.

G. Joint Treatment

As listed below and where shown on the Contract Drawings:

1. Unfinished (Joints not taped).

2. For use with ASTM C 36 Drywall: ASTM C 475 and as follows:

   a. Joint Tape: Paper reinforcing tape

   b. Joint Compound

      Ready-mixed vinyl-type. Provide two separate grades; one specifically for bedding tapes and filling depressions, and one for topping and sanding.

3. For use with ASTM C 630 drywall:

   a. Joint Tape: ASTM C 475 paper reinforcing tape.

   b. Water resistant joint compound

      Special water resistant type for treatment of joint, fastener heads and cut edges of water-resistant backing board.

H. Miscellaneous Materials

Provide auxiliary materials for gypsum drywall Work of the type and grade recommended by the manufacturer of the system.

1. Laminating Adhesive

   Special adhesive or joint compound specifically recommended for laminating gypsum boards.

2. Gypsum Board Fasteners: Comply with GA-216.

I. Concealed Acoustical Sealant (if required)

Non-drying, non-hardening, non-skinning, non-staining, non-bleeding, gunnable sealant for concealed applications per ASTM C 919.

J. Exposed Acoustical Sealant (if required)

Non-oxidizing, skinnable, paintable, gunnable sealant for exposed applications per ASTM C 919.

K. Blanket Insulation

Where shown on the Contract Drawings, per ASTM C 665 and as follows:

1. For Sound Attenuation: Type I, thickness as shown.

2. For Thermal Insulation: Type II, Class A, "R value" as shown.

PART 3 - EXECUTION

3.01 PREPARATION

A. Pre-Installation Conference

Prior to the start of shaft system installation, meet at the construction site with the installers of related Work including Work requiring openings, chases, frames, access panels, installation of mechanical, electrical and communications systems, support and similar integrated requirements including interference and conflicts, and coordinate layout and sequencing requirements for proper integration of the Work.

B. Weather Exposure: Comply with 1.04 of this Section.

3.02 INSTALLATION

A. Installation of Basic System Components

Comply with the manufacturer's installation instructions and with applicable requirements of the industry standards listed below:

1. Metal Support Installation Standard: ASTM C 754.

2. Gypsum Board Application and Finishing Standards: ASTM C 840 and GA-216.

3. Rated assemblies, if any, shall comply with applicable GA-600 or UL Fire Resistance Directory.

B. Anchor and fasten materials and components to comply with ratings and performance requirements.

C. Do not bridge building expansion joints, if any, with drywall shaft system, frame both sides of joints with furring and other support as shown on the Contract Drawings.

D. Install supplementary framing, blocking and bracing to support fixtures, equipment, services, heavy trim furnishings and similar Work which cannot be adequately supported directly on gypsum drywall shaft system.

1. Where handrails are shown on the Contract Drawings for direct attachment to drywall shaft system, provide not less than a 20 gage x 4 inch wide galvanized steel reinforcement strip, accurately positioned and secured behind not less than a 5/8 inch thick course of gypsum board in the system.

E. Coordinate drywall shaft system Work with sprayed-on fireproofing of the structure, if required, so that both remain complete and undamaged. Patch or replace sprayed-on fireproofing removed or damaged during the installation of the shaft system.

F. Integrate stair hanger rods with drywall shaft system where shown on the Contract Drawings, by locating cavity of system as required to enclose rods.

G. Isolate shaft system from transfer of structural loading to system, both horizontally and vertically. Provide slip or cushioned type joints to attain lateral support and avoid axial loading. Comply with details shown on the Contract Drawings and with the manufacturer's instructions.

H. Seal perimeter of each section of drywall shaft Work where it abuts other Work. Install a second bead of sealant in a location and manner which will prevent dislocation by air pressure differential between shaft and external spaces. Seal joints and penetrations in the Work and comply with manufacturer's instructions.

I. Special Application Requirements for Drywall Finish

Where room-side of drywall shaft Work is shown on the Contract Drawings to receive drywall finish, including spaces shown or scheduled for paint or wall coverings, provide exposed boards with tapered edges and recessed fastener heads, ready for drywall finishing. For unfinished drywall Work on shaft side, edge profile need not be tapered unless necessary to comply with requirements for fire-resistance and STC ratings, if any.

J. Installation of Drywall Trim Accessories

Install metal trim accessories where room-side of drywall shaft system is shown on the Contract Drawings to receive drywall finish (tape and joint compound treatment), including spaces shown or scheduled for paint or wall coverings. Nail or staple the flanges of accessories in accordance with the manufacturer's instructions, and fasten integrally with gypsum board where possible. Apply trim wherever edge of gypsum board would otherwise be exposed or semi-exposed, including terminations of the Work, openings in the Work, external corners, expansion and control joints and similar edges, both exposed and abutting other Work. Miter-cut corners of exposed trim accessories, and spline-reinforce from behind to eliminate offsets and misalignments.

1. Install L-type trim where board edges abut other Work without space or reveal.

2. Install U-type rim where board edges are shown on the Contract Drawings for sealant or gasket application, or would otherwise be exposed (special kerf-type where kerf is provided to receive trim).

3. Install semi-finishing trim where shown on the Contract Drawings.

4. Install control-joint trim (beaded type) where shown on the Contract Drawings.

K. Installation of Drywall Finishing

1. General

Apply treatment at gypsum board joints (both directions), flanges of trim accessories, penetrations, fastener heads, surface defects and elsewhere as required to prepare Work for decoration. Prefill open joints and rounded or beveled edges, using type of compound recommended by the manufacturer.

a. Apply joint tape at joints between gypsum boards, except where a trim accessory is shown on the Contract Drawings.

b. Apply joint compound in three coats (not including prefill of opening in base), and sand between last two coats and after last coat.

2. Partial Finishing (if required)

Omit third coat and sanding on concealed drywall Work which is shown on the Contract Drawings for drywall finishing or which requires finishing to achieve fire-resistance rating, sound rating or to act as air or smoke barrier.

3.03 PROTECTION

Provide final protection and maintain conditions, in a manner which will ensure gypsum drywall Work being without damage or deterioration at time of issuance of the Certificate of Final Completion.

END OF SECTION

A 5/7/91

SECTION 09336

THIN-SET GRANITE TILE INSTALLATION

(THIN SEPARATION MEMBRANE METHOD)

PART 1 - GENERAL

1.01 SUMMARY

A. This Section specifies requirements for the furnishing of grouting and accessory materials and installation of granite tile and porcelain paver tile.

B. Granite tiles will be furnished to the Contractor by the Authority.

1.02 REFERENCES

The following is a listing of the publications referenced in this Section:

American National Standards Institute (ANSI)

ANSI A 108.1	Glazed Wall Tile, Ceramic Mosaic Tile, Quarry Tile and Paver Tile Installed with Portland Cement Mortar
ANSI A 108.4	Ceramic Tile Installed with Organic Adhesives or Water Cleanable Tile Setting Epoxy Adhesive
ANSI A 108.5	Ceramic Tile Installed with Dry-Set Portland Cement Mortar or Latex-Portland Cement Mortar
ANSI A 108.10	Installation of Grout in Tilework
ANSI A 118.4	Latex-Portland Cement Mortar
ANSI A 137.1	Ceramic Tile
ANSI A 185	Welded Steel Wire Fabric for Concrete Reinforcement

Tile Council of America (TCA)

Handbook for Ceramic Tile Installation

1.03 ENVIRONMENTAL REQUIREMENTS

A. Maintain temperature at not less than 50 degrees F in tiled areas during installation and for not less than 7 days after completion, unless a higher temperature is required by the manufacturer's instructions.

B. Vent temporary heaters, if used, to exterior to prevent damage to tile work from carbon dioxide buildup.

1.04 QUALITY ASSURANCE

A. Source of Materials

Provide materials obtained from one source for each type and color of setting material, grout, sealer, cleaner, and joint sealant.

B. Material Compatibility

Submit letters from the manufacturers and/or suppliers of setting materials, grout, sealer, and cleaners certifying full compatibility of each material with all other materials proposed by Contractor for tile installation specified in this Section, including full compatibility with granite tiles and all special shapes.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Contractor shall pick-up granite tiles at designated Authority storage location and deliver to construction site.

B. Deliver and store tiles in original grade-sealed cartons with seals unbroken and labels intact until time of use.

C. Keep materials dry until ready for use. Prevent damage or contamination by water, freezing or other causes.

1.06 SUBMITTALS

A. Submit the following in accordance with the requirements of "Shop Drawings, Catalog Cuts, and Samples", of Division 1 GENERAL PROVISIONS:

1. Submit manufacturers' and/or suppliers' technical information and installation instructions for materials furnished under this Section.

2. Samples

a. For Selection Purposes

For grout colors, submit manufacturer's complete color charts for color selection by the Engineer.

b. For Verification Purposes

Minimum 3 inch long samples of actual joint width(s) shown on the Contract Drawings, or if not shown on the Contract Drawings as specified herein, of colors selected from color charts submitted above.

B. Submit to the Engineer for approval letters of certification for all materials, as required by 1.04B of this Section. Sample of and technical information concerning granite materials to be furnished by the Authority for this Contract will be available for inspection by the Contractor in the Engineer's office.

C. Submit to the Engineer one copy of U.S. Department of Labor Material Safety Data Sheets (MSDS) for all hazardous chemicals utilized during Work of this Section.

PART 2 - PRODUCTS

2.01 MATERIALS

A. General

Comply with specified ANSI standard for tile installation materials unless more stringent requirements are specified in this Section.

B. Bond Coat

Laticrete No. 280 Floor Mix Thin-Set gaged with Laticrete 333 Super Flexible Mortar Additive in accordance with latex manufacturer's printed instructions or approved equals.

C. Anti-Fracture Membrane

Latricrete 9235 Waterproof Membrane or approved equal. Use fabric recommended by anti-fracture membrane manufacturer.

D. Grouting Material

Manufacturer's preblended compound of Portland cement, selected and graded aggregates, color pigments and chemical additives gaged with latex additive to comply with the manufacturer's directions; color as shown on the Contract Drawings, or if not shown as directed by the Engineer as manufactured by the following:

1. Laticrete No. 3701, manufactured by Latricete International Inc., Bethany, CT or approved equal.

E. Water shall be clean and potable.

F. Stone Accessories

1. Cleaner

Provide stone cleaners of proper formulation for kinds of stones, finishes and applications shown on the Contract Drawings and compatible with specified grout type, as recommended by stone fabricator and/or supplier and by sealer manufacturer. Do not use acid-type cleaning agents or other cleaning compounds containing caustic or harsh fillers, except where expressly approved by stone producer for type of condition involved.

a. Subject to compliance with requirements of this Section, provide the following cleaner:

1) Aqua Mix Miracle Cleaner, manufactured by Aqua Mix Inc., Santa Fe Springs, CA 90670 or approved equal.

2. Sealer for Floors

Colorless, slip and stain resistant sealer which will not affect color or physical properties of stone or grout surface, as recommended by manufacturer and by stone fabricator and/or supplier for application shown on the Contract Drawings.

a. Subject to compliance with requirements of this Section, provide the following sealer:

1) Aqua Mix Penetrating Sealer, manufactured by Aqua Mix Inc., Santa Fe Springs, CA 90670 or approved equal.

2.02 MIXES

Proportion and mix components in accordance with the manufacturer's printed instructions.

PART 3 - EXECUTION

3.01 EXAMINATION

Examine surfaces to receive tile work. Ensure that installation conditions comply with 1.03 of this Section and surfaces conform to the following before proceeding with tile installation(s). Do not proceed with tile work until surfaces and conditions comply with specified requirements:

A. Floors

a. Maximum variation in sub-floor surface shall be 1/4 inch in 10 ft. from the required plane.

b. Where floor drains are shown on the Contract Drawings the subfloor slope shall be a minimum of 1/4 inch per foot in the direction of the floor drain.

B. Grounds, anchors, plugs, hangers, expansion joints, door frames, electrical, mechanical, and other Work over or around which granite tile is to be installed.

3.02 PREPARATION

A. Scarify existing terrazzo substrate with course grit sand paper to remove all surface work, dirt, and sealers.

B. Wipe surface with a damp mop to completely remove dust.

C. Treat all hairline cracks in existing terrazzo substrate with anti-fracture membrane specified herein. Apply liberal coat of liquid (specified in 2.01 C of this Section) with paint brush or roller to cover at least three inches on either side of crack. Roll out enough fabric to cover liquid and then firmly brush or roll on a top coat of liquid.

D. When surface is dry to the touch, apply thin load-bearing separation membrane as follows:

1. Apply liberal coat of liquid (specified in 2.01 C of this Section) with a roller.

2. Roll out enough fabric to cover liquid; imbed while liquid is still wet.

3. After laying fabric into liquid, firmly roll on a top coat of liquid.

4. Allow to dry 2-8 hours, until dry to the touch. Apply additional coat of liquid.

5. When surface is dry to the touch (approximately 24 hours later), it is ready for application of the bond coat and granite tiles.

3.03 INSTALLATION

A. General

1. Comply with applicable installation methods of TCA "Handbook for Ceramic Tile Installation" for installation conditions shown on the Contract Drawings and applicable parts of ANSI A 108.1, ANSI A 108.5 or ANSI A 108.10 installation standards.

2. Unless otherwise shown on the Contract Drawings, extend tile into recesses and under or behind equipment and fixtures to form a complete covering without interruptions. Neatly terminate work at obstructions, edges and corners without disrupting pattern or joint alignment.

3. Perform cutting and drilling of tile without marring visible surfaces. Grind cut edges of tile abutting trim, finish or built-in items. Fit tile closely to openings and penetrations so that collars, plates or covers will overlap tile.

4. Unless otherwise shown on the Contract Drawings, lay tile in grid pattern. Layout tile and center tile fields in both directions in each space or on each wall area.

5. Unless otherwise shown on the Contract Drawings, provide uniform joint widths of 1/16 inch.

6. Provide sealant filled joints at wall/floor terminations, around floor drains, around floor penetrations and at such control, contraction, expansion and isolation joints shown on the Contract Drawings; or if not shown, at spacings and locations recommended in TCA "Handbook for Ceramic Tile Installation" Method EJ 171, and approved by the Engineer. Refer to Division 7 Section of these Specifications on sealants.

7. Do not use stone units with chips, cracks, voids, strains or other defects which might be visible in the finished Work. If greater than two percent of the stone units are defective, notify the Engineer immediately.

8. Clean stone before setting by scrubbing with fiber brushes and follow by a thorough drenching with clear water. Use only mild cleaning compounds that contain no caustic or harsh fillers or abrasives. If not thoroughly wet at time of setting, drench or sponge stone, in accordance with fabricator's or supplier's printed instructions.

B. Floor Installation

1. TCA F113 (Cement Mortar Anti-Fracture Membrane), with latex-bond coat and grout and modified as follows:

a. Apply Anti-Fracture Membrane materials specified in 2.01 C as specified in 3.02D of this Section.

b. Apply bond coat.

c. Follow ANSI reference standards requirements for setting tiles to ensure maximum possible bond between bond coat and tile.

1) "Back Butter" Granite with bond coat.

2) Perform beating of tiles with a rubber mallet.

d. Tamp tiles in place to create an even plane with no lippage.

e. Grout mix shall have latex additive and shall be mixed in accordance with latex additive manufacturer's printed instructions.

f. Grout joints shall be full to the surface of the granite tile. Wipe all excess grout from the surface of the granite tile, promptly.

g. Upon completion of grouting, when grout is thoroughly dry, buff the surface of granite tiles to remove surface laitance.

2. For bond coat and grouting materials see Part 2 of this Section.

C. Wet down tile during installation to allow mortar and grout materials to maintain moisture as recommended by grout/or morter manufacturer and in accordance with tile manufacturer's and fabricator's and/or supplier's printed instructions.

D. Cleaning

Upon completion of placement and grouting, clean stone tile surfaces and surfaces of stone wall bases and thresholds, if any, so they are free of grout haze and foreign matter.

F. Apply sealer to cleaned interior stone flooring, wall bases, and thresholds, if any, in compliance with sealer manufacturer's instructions.

3.04 PROTECTION

A. Leave finished tile work clean and free of cracked, chipped, broken, unbonded or otherwise defective tile.

B. When recommended by tile manufacturer(s), apply a neutral protective cleaner to completed tile installation(s).

C. Protect tile installation(s) with Kraft paper or other heavy covering during construction period.

D. Prohibit foot and wheel traffic from using tiled floors for at least 3 days after grouting is complete. As directed by the Engineer, when foot and wheel traffic cannot be prohibited for the full 3 days, cover flow areas with plywood for protection.

E. Before issuance of the Certificate of Final Completion, remove protective coverings and rinse neutral cleaner, if any, from tile surfaces.

END OF SECTION

DIVISION 9

SECTION 09910

PAINTING

PART 1 - GENERAL

1.01 SUMMARY

A. This Section specifies requirements for construction site application of paint and finish materials.

B. Unless otherwise shown on the Contract Drawings, or specified herein, Work of this Section includes surface preparation and field painting and finishing of the following items and surfaces:

1. Exterior painting in accordance with Appendix "A" to this Section.

2. Interior painting in accordance with Appendix "B" to this Section.

3. Exposed bare and covered pipes and ducts, and conduits, including color coding (if any), and hangers and supports.

4. Shop primed or galvanized steel and iron Work, and metal items and surfaces of architectural, mechanical and electrical items, if any.

a. Shop priming or galvanized, and surface preparation and treatment of such items is specified in other Sections of the Specifications.

5. Architectural woodwork and casework, if any.

a. Surface preparation and shop staining or finishing of such items as specified in other Sections of the Specifications.

C. Do not paint or finish the following surfaces unless otherwise shown on the Contract Drawings:

1. Items with factory-applied final finish.

2. Finished metal surfaces of anodized aluminum, stainless steel, chromium plate, copper, bronze, and similar finished metals.

3. Concealed pipes, ducts and conduits.

4. Concealed or inaccessible surfaces.

5. Code required labels such as Underwriters Laboratories, or Factory Mutual.

6. Identification, performance rating, name or nomenclature plates of mechanical or electrical fire equipment.

7. Operating or moving parts of operating units or mechanical and electrical equipment such as: valves, damper operators, linkages, sinkages, sensing devices, motors, shafts and sheaves.

8. Surfaces shown or scheduled on the Contract Drawings to receive sprayed on fireproofing or mineral fiber treatment.

1.02 REFERENCES

The following is a listing of the publications referenced in this Section:

Steel Structures Painting Council (SSPC)

SSPC PA 1 Shop, Field & Maintenance Painting

SSPC PA 2 Measurement of Dry Paint Thickness with Magnetic Gages

SSPC SP 1 Solvent Cleaning

SSPC SP 3 Power Tool Cleaning.

1.03 ENVIRONMENTAL REQUIREMENTS

A. Comply with the manufacturer's recommendations as to environmental conditions under which paint and finishes may be applied, and the following:

1. Do not apply paints or finishes in rain, snow, fog or mist, or when relative humidity exceeds 85 percent; or to damp or wet surfaces unless otherwise permitted by the manufacturer's printed instructions. Painting and finishing may be performed during inclement weather if areas and surfaces to be painted or finished are enclosed and heated within temperature limits specified by the manufacturer(s) during application and drying periods.

2. Apply solvent-thinned paint or finish only when temperature of surfaces to be painted or finished and surrounding air temperatures are between 45 degrees F and 95 degrees F, unless otherwise permitted by the manufacturer's printed instructions.

3. Apply water-base paint or finish only when temperature of surfaces to be painted or finished and surrounding air temperatures are between 50 degrees F and 90 degrees F, unless otherwise permitted by the manufacturer's printed instructions.

4. Apply paint or finish to ferrous and non-ferrous metal surfaces only when the surface temperature is at least 5 degrees F above the dewpoint.

5. Apply paint or finish to non-metal surfaces only when the moisture content of surfaces are below the following maximums, measured using an electronic moisture meter:

   a. Plaster and gypsum wallboard: 12 percent
   b. Concrete and masonry: 12 percent
   c. Wood: 15 percent

B. Do not perform Work of this Section in areas where dust is being generated.

C. Do not perform surface preparation procedures when the U.S. Weather Bureau forecasts precipitation which would commence prior to completion of such procedures and application of paint or finishing material.

D. For Work in enclosed spaces, where worker respiratory equipment is not utilized, provide continuous ventilation during preparation, painting or finishing and for 48 hours after application of paint.

1.04 QUALITY ASSURANCE

Single Source Responsibility

Provide primers or other undercoat materials produced by same manufacturer as finish topcoat. Use only thinners and surface cleaning materials recommended by finish topcoat manufacturer, and use within recommended limits.

Finish System Compatibility

Review other Sections of the Specifications to determine shop primer and surface preparation and treatment provided for the various substrates and items which are to be field painted or finished as Work of this Section. Review information on characteristics of such primers, surface preparations and treatments, and furnish information on characteristics of materials provided as Work of this Section when requested by other trades, to ensure compatibility with products applied as Work of this Section.

1. Notify the Engineer in writing of compatibility problems associated with the Work of this Section and substrates primed under other Sections of these Specifications.

2. Provide barrier coats over incompatible primers, or remove and reprime as directed by the Engineer.

C. Where shown on the Contract Drawings, provide not less than a 100 square foot full-coat finish sample(s) on actual surface(s) for coating material to be applied as Work of the Section, at a location selected by the Engineer. Such sample(s), when approved by the Engineer, may be incorporated into the Work and shall be used to establish the standard for color, texture and workmanship for the remainder of the Work of this Section.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in the manufacturer's original unopened packages and containers bearing manufacturer's name, label and the following information:

1. Name or title material.

2. Manufacturer's stock number and date of manufacture.

3. Contents by volume, for major pigment and vehicle constituents.

4. Thinning instructions.

5. Application instructions.

6. Color name and number.

7. Handling instructions and precautions.

B. Store materials not in actual use in tightly covered containers at a minimum ambient temperature of 45 degrees F in a well-ventilated area. Maintain containers used in storage of coatings in a clean condition, free of foreign materials and residue. Protect from freezing where necessary. Keep storage area neat and orderly. Remove oily rags and waste daily. Take all necessary precautionary measures to ensure that workmen and Work areas are adequately protected from fire hazards and health hazards resulting from handling, mixing and application of materials.

C. Deliver paint and enamel topcoats ready mixed to approved colors. Construction site mixing and tinting are prohibited.

D. *Extra Material*

Where requirement for extra materials are shown on the Contract Drawings, deliver to the Engineer prior to issuance of the Certificate of Final Completion, not less than one gallon of each type of color of each finish material applied as Work of this Section. Container(s) shall be the manufacturers's original, unopened, clearly labeled for product identification an Contract number.

1.06 SUBMITTALS

A. Submit the following in accordance with the requirements of "Shop Drawings, Catalog Cuts, and Samples" of Division 1 - GENERAL PROVISIONS:

1. Product Data

Manufacturer's technical information including label analysis and application instructions for each material.

2. Samples

On a 6 inch x 6 inch hardboard, two samples of each paint and coating material, with texture to simulate actual conditions.

(1) Identify each sample as to manufacturer, color name and number, location and application.

(2) Submit in color(s) shown on the Contract Drawings, or if not shown, in color(s) as selected by the Engineer from manufacturer's color chart submitted prior to preparation of hardboard samples.

(3) On actual wood surfaces, two 4 inch x 8 inch samples of each natural and stained wood material. Identify each sample as to manufacturer and location application.

B. Submit to the Engineer one copy of U.S. Department of Labor, Material Safety Sheets (MSDS) for hazardous chemicals utilized during the Work of this Section.

C. Submit copy of daily log reports, as required by 3.03 B.2 of this Section if requested by the Engineer.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Provide products of manufacturers in accordance with Appendix "C" to this Section, or approved equal.

When materials or products proposed to be used are products of manufacturers other than manufacturers specified in Appendix "C" to this Section, submit product information in accordance with the requirements of of Division 1 GENERAL PROVISIONS.

2.02 MATERIALS

A. Provide paint system(s) for the various substrates as listed in Appendix "A" or Appendix "B" to this Section.

B. Provide colors as shown on the Contract Drawings, or if not shown as required by 1.06 A.2 of this Section.

2.03 MIXES

A. Mix and prepare painting materials in accordance with the manufacturer's instructions and 1.05 C of this section.

B. Stir materials before application, and as required during application to produce a mixture of uniform density. Do not stir surface film into material. Remove film and, if necessary, strain material before using.

C. Tinting

Tint each under coat a lighter shade to facilitate identification of each coat where multiple coats are to be applied as shown on the Contract Drawings. Tint undercoats to match the color of finish coat, but provide sufficient difference in shade of undercoats to distinguish each separate coat.

PART 3 - EXECUTION

3.01 PREPARATION

A. General

Perform preparation and cleaning procedures in accordance with the paint manufacturer's instructions and as specified in this Section, for each particular substrate condition.

1. Ensure finish system compatibility in accordance with 1.04 B of this Section.

2. Ensure that environmental conditions conform to requirements of 1.03 A of this Section.

3. Remove hardware, hardware accessories, machined surfaces, plated, lighting fixtures, and similar items in place and not to be finish-painted, or provide surface-applied protection prior to surface preparation and painting of items and adjacent surfaces. Following completion of painting of each space or area, reinstall removed items.

4. For previously painted surfaces, glossy surfaces are to be dulled by sanding lightly with #00 sandpaper.

5. Thoroughly clean and remove all dust, oil, grease and other contaminants from surfaces to be painted. Schedule cleaning and painting so that contaminants from cleaning process will not fall onto wet, newly-painted surfaces.

B. Ferrous Metals

Clean ferrous surfaces, which are not galvanized or shop-coated, of oil, grease, dirt, loose mill scale and other foreign substances by solvent and mechanical cleaning in accordance with SSPC-SP 1 and SSPC-SP 3.

C. Galvanized Steel and Aluminum Surfaces

Clean surfaces of oil, grease, dirt, loose mill scale and other foreign substances. Remove all white rust by hand or power brushing. Care shall be taken not to damage or remove galvanizing. Use solvent cleaning in accordance with SSPC-SP1.

D. Cementitious Materials

Prepare cementitious surfaces of concrete, concrete block, cement plaster to be painted by removing efflorescence, chalk, dust, dirt, grease, oils, and by roughening as required to remove glaze.

1. Determine alkalinity and moisture content of surfaces to be painted by performing appropriate tests. If surfaces are found to be sufficiently alkaline to cause blistering and burning of finish paint, correct this condition before application of paint. Do not paint over surfaces where moisture content exceeds that permitted in 1.03 A.5. of this Section.

2. Clean concrete floor surfaces shown on the Contract or scheduled to be painted with a commercial solution of muriatic acid, or other etching cleaner. Flush floor with clean water to neutralize acid, and allow to dry before painting.

E. Wood

Wipe off dust and grit from miscellaneous wood items and millwork prior to priming. Spot coat knots, pitch streaks and sappy sections with sealer. Fill nail holes and cracks after primer has dried and sand between coats. Back prime interior and exterior woodwork.

1. Where clear finishes are shown on the Contract Drawings, ensure that fillers match wood tint. Work fillers into grain. Wipe excess from the surface.

3.02 APPLICATION

A. General

Apply paint in accordance with SSPC PA-1 and the manufacturer's directions. Use applicators and techniques best suited for substrate and type of material being applied.

1. Apply each coat at proper consistency.

2. Tint each coat in accordance with 2.03 C of this Section.

3. Apply additional coats when undercoats, stains or other conditions show through final coat of paint, until paint film is of uniform finish, color and appearance. Give special attention to insure that surfaces, including edges, corners, crevices, welds, and exposed fasteners receive a dry film thickness equivalent to that of flat surfaces.

4. Paint surfaces behind movable equipment and furniture same as similar exposed surfaces. Paint surfaces behind permanently-fixed equipment or furniture with prime coat only before final installation of equipment.

5. Paint interior surfaces of ducts, where visible through registers or grilles, with a flat, non-specular black paint.

6. Paint back sides of access panels, and removable or hinged covers to match exposed surfaces.

7. Finish exterior doors on tops, bottoms and side edges same as exterior faces, unless otherwise shown on the Contract Drawings.

8. Sand lightly between each succeeding enamel or varnish coat.

9. Omit first coat (primer) on metal surfaces which have been shop-primed and touch-up painted, unless otherwise shown on the Contract Drawings.

10. Finish paint primed items and equipment to color shown on the Contract Drawings.

11. Unless otherwise shown on the Contract Drawings, prime and paint to match adjacent surface; exposed insulated and bare pipe and ducts, conduits, boxes, hangers, brackets, and supports, except where items are covered with a prefinished coating.

12. Color code equipment, piping conduit and exposed ductwork as shown on the Contract Drawings.

B. Scheduling Painting

Apply first-coat material to surfaces that have been cleaned, pretreated or otherwise prepared for painting as soon as practicable after preparation and before subsequent surface deterioration.

1. Allow sufficient time between successive coatings to permit proper drying. Do not recoat until paint has dried to where it feels firm, does not deform or feel sticky under moderate thumb pressure, and application of another coat of paint does not cause lifting or loss of adhesion of the undercoat.

C. Minimum Coating Thickness

Apply materials at not less than manufacturer's recommended spreading rate, to establish a total dry film thickness as shown on the Contract Drawings or, if not shown, as recommended by coating manufacturer.

D. Completed Work

Match approved samples for color, texture and coverage. Remove, refinish or repair Work not in compliance with the requirements specified in this Section.

E. Clean-up

During progress of Work, remove discarded paint materials, rubbish, cans and rags daily. Upon completion of painting Work, clean window glass and other paint-spattered surfaces. Remove spattered paint by proper methods of washing and scraping, using care not to scratch or otherwise damage finished surfaces.

3.03 FIELD TESTS

A. Monitor paint application rate by use of wet film thickness gauge; multiply wet film thickness by the percent of solids by volume of the coating to determine the theoretical dry film thickness.

B. After first coat has dried, visually examine for pinholes, fish eyes, blisters, runs, sags or missed areas. Repair defects and repaint as required.

1. On ferrous substrates, after visual examinations:

a. Measure dry film thickness by use of dry film thickness gauge in accordance with use and calibration requirements of SSPC-PA2.

b. Ensure that surfaces are free of skips, voids or pinholes, in any coat, by testing with low-voltage (less than 90V) detector.

2. Maintain a daily log of inspections and test results. Submit a copy of such log to the Engineer if requested.

C. The Authority reserves the right to require the following material testing procedure at any time, and any number of times during period of field painting:

1. Engage services of its in-house testing laboratory, The Port Authority of New York & New Jersey - Materials and Research Division, to sample paint being used. Samples of materials delivered to construction site will be taken, identified and sealed, and certified in presence of Contractor.

2. Testing laboratory will perform appropriate tests for any or all of the following characteristics: Abrasion resistance, apparent reflectivity, flexibility, washability, absorption, accelerated weathering dry opacity, accelerated yellowness, recoating, skinning, color retention, alkali resistance and quantitative materials analysis.

3. If test results show that material being used does not comply with specified requirements, Contractor may be directed to stop painting Work, and remove non-complying paint; pay for testing; repaint surfaces coated with rejected paint; remove rejected paint from previously painted surfaces if, upon repainting with specified paint, the two coatings are non-compatible.

3.04 PROTECTION

Protect other adjacent work against damage by painting and finishing Work. Correct damage by cleaning, repairing or replacing, and repainting, as approved by the Engineer.

A. Provide "Wet Paint" signs as required to protect newly painted finishes. Remove temporary protective wrappings provided by others for protection of their Work, after completion of painting operations.

B. At completion of Work of other trades, touch-up and restore damaged or defaced painted surfaces.

END OF SECTION

SECTION 09910

APPENDIX "A"

PAINT APPLICATION SCHEDULE - EXTERIOR SURFACES

NO EXTERIOR PAINTING FOR WORK OF THIS CONTRACT

END OF APPENDIX "A"

PAINT APPLICATION SCHEDULE - INTERIOR SURFACES - continued

Surface	System Designation	Primer	2nd Coat	3rd Coat
Gypsum Wallboard Walls, Ceilings & Soffits-Flat Finish	GW-1F	Latex Primer (Tint to color)	Latex Flat	None
Gypsum Wallboard Walls, Ceilings & Soffits-Semi-Gloss Finish	GW-1S	Latex Primer (Tint to color)	Latex Semi-Gloss Enamel	None
Steel-Light Duty Flat Finish	S-2F	Metal Primer	Latex Flat	None
Steel-Light Duty Semi-Gloss Finish	S-2S	Metal Primer	Alkyd Semi-Gloss Enamel	None
Steel-Light Duty Gloss Finish	S-2G	Metal Primer	Alkyd Glossy Enamel	None
Tin, Copper & Brass-Light Duty Flat Finish	NF-2F	Non-Ferrous Metal Primer	Latex Flat	None
Tin, Copper & Brass-Light Duty Semi-Gloss Finish	NF-2S	Non-Ferrous Metal Primer	Alkyd Semi-Gloss Enamel	None
Tin, Copper & Brass-Light Duty Gloss Finish	NF-2G	Non-Ferrous Metal Primer	Alkyd Glossy Enamel	None
Steel-Heavy Duty-Gloss Finish	S-1G	Zinc Rich Epoxy Polyamide Primer or Zinc Rich Inorganic Primer	Epoxy Primer (Low Gloss)	Aliphatic Polyurethane
Steel-Heavy Duty-Semi-Gloss Finish	S-1S	Zinc Rich Epoxy Polyamide Primer or Zinc Rich Inorganic Primer	Epoxy Primer (Low Gloss)	Aliphatic Polyurethane (Low Gloss)

SECTION 09910

APPENDIX "C"

ACCEPTABLE MANUFACTURERS - PRIMERS - continued

Primers	Glidden	P.P.G.	Sherwin Williams	Con-Lux Coatings, Inc.
Concrete Block Base Coat	Glid Tile Base Coat 5512	PITT Glaze High Solids Block Filler White 16-90	Kem Cati-Coat Epoxy Filler/ Sealer B42WA8/ B42WA9	Epolon 65 Block Filler
Oil-Modified Polyurethane (Clear)				Crystalthane 79 Gym Floor Finish
Water Based Latex Primer	Ultra-Hide PVA Primer - Sealer 5019	Speedhide Quick Drying Latex Primer-Sealer 6-2	Pro Mar 200 Latex Wall Primer B28W200	Jet-Plex 495 White Primer
Traffic Paint			S-W Setfast Acrylic/Vinyl Acrylic	Safety-Plex

SECTION 15310

SPRINKLER FIRE PROTECTION

PIPING AND APPURTENANCES

PART 1 - GENERAL

1.01 SUMMARY

A. This Section specifies requirements of piping and appurtenances for automatic sprinkler fire protection systems.

B. Automatic sprinkler fire protection systems specified in this Section are:

Wet-Pipe System
Dry-Pipe System
Pre-Action System
Deluge System
Combined Dry-Pipe and Pre-Action System

1.02 REFERENCES

(Not used)

1.03 DESIGN AND PERFORMANCE REQUIREMENTS

A. Design and performance of components and methods specified herein shall comply with the applicable provisions of the codes, standards, recommendations of the entities listed below.

New York City Building Code

New York City Board of Standards and Appeals

The BOCA Basic Building Code

The BOCA Basic Fire Prevention Code

City of Yonkers Building Code

Municipal Water Company

American National Standards Institute (ANSI)

American Society for Testing and Materials (ASTM)

Factory Mutual Research Corp. (FM)

National Fire Protection Association (NFPA)

Underwriters Laboratories Inc. (UL)

In addition, specific provisions cited herein shall govern for the Associated Specific Application.

B. The sprinkler installation shall be designed in accordance with NFPA 13 and shall be either a pipe schedule system or a hydraulically designed system.

C. In buildings requiring specialized sprinkler systems, additional applicable standards as referenced in NFPA 13 shall be used for design, including but not limited to the following: NFPA 15, 16, 231, 231C, 231D and 409.

D. Sprinkler fire protection piping and appurtenances shall be UL listed, and approved by FM and those authorities having jurisdiction, if this Contract were being performed for a private corporation, as applicable.

E. Design shall be based on water supply information as shown on the Contract Drawings or, if not shown, as determined by a water flow test by the Contractor.

1.04 QUALITY ASSURANCE

A. Fire protection piping and appurtenances, of types and sizes required, shall have been satisfactorily used for purposes similar to those intended herein for not less than three years.

B. Entities performing Work shall have experience on at least two projects involving complexities similar to those required under this Contract.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Clean all pipe sections of foreign matter and cover ends with temporary sheet metal closures or plastic end caps of sufficient tightness to prevent entry of foreign matter prior to shipping to the construction site.

B. Store pipe, fittings, valves and other components at the construction site on pallets or raised platforms with suitable coverings satisfactory to the Engineer to protect them against damage and weather.

C. Inspect all pipe, fittings, valves and other components for damage before moving them from storage to the point of installation at the construction site.

1.06 SPARE PARTS

Provide a red, steel cabinet containing the following spare sprinkler heads with their respective installing wrenches:

Systems of up to 300 heads - 6 spares
Systems of 300 to 1000 heads - 12 spares
Systems of above 1000 heads - 24 spares

Stock of spare sprinkler heads shall include all types and temperature ratings installed and shall not be less than six for each type and rating.

1.07 SUBMITTALS

A. Submit the following in accordance with the requirements of "Shop Drawings, Catalog Cuts, and Samples" of Division 1 - GENERAL PROVISIONS:

1. Detailed shop drawings, including the hydraulic calculations, when required, in accordance with the requirements of NFPA 13 or other applicable standards. The drawings shall include all partitions, lights, ceiling construction, sprinkler heads, piping, hanger locations, vertical and horizontal piping offsets, pipe elevations, room designations, control valves, and water supply information. Such shop drawings shall show the specific standards, codes, and sections thereof which apply and the design hydraulic areas and parameters, and available water supply test results.

2. Electrical wiring diagrams

3. Catalog cuts for the following:

a. Sprinkler heads
b. Fittings and flanges
c. Valves
d. Tamper switches and alarm devices
e. Hangers and supports
f. Sleeves and escutcheons
g. Valve tags and pipe identification bands
h. Pressure gauges
i. Siamese connections
j. Other specialty items specified in this Section

4. Piping material and schedule for each piping system

5. Valve charts and schedules

6. Access ladder drawings

7. List of access doors

B. Submit operation and maintenance manuals, including replacement and spare parts lists for automatic sprinkler fire protection systems.

C. Submit field test results.

PART 2 - PRODUCTS

2.01 PIPE, FITTINGS, AND FLANGES

A. Provide pipe, fittings, and flanges in accordance with the "PIPE, FITTINGS, AND FLANGES SCHEDULE" specified below, including gaskets, bolts, nuts, washers and other pressure containing parts necessary for the complete installation of piping systems.

B. Nipples shall be extra-heavy shoulder type of same material as pipe; close nipples are not acceptable.

C. Unless otherwise shown on the Contract Drawings, piping connections to equipment shall be made up with unions for piping 2 inches and smaller and shall be flanged for piping 2 1/2 inches and larger.

D. Gasket for flanges shall be 1/16-inch thick (after compression), rubber or neoprene, full-faced, and punched bolt holes.

E. Provide insulating flanges, couplings or unions where brass or copper pipe connects to ferrous pipe material. Flanged connections shall be made with gaskets, sleeves and washers of dielectric material for complete insulation between flanges, bolts, nuts and washers.

F. Grooved Piping Mechanical Couplings

1. Couplings shall be complete with gaskets, bolts and nuts recommended by the manufacturer for the service. Use vandalproof nuts and bolts on vertical piping in stairs.

2. Couplings shall be Victaulic "Style 75" lightweight for system pressure not exceeding 400 psi (including shut-off pressure of fire pump and static street pressure of water main) and Victaulic "Style 77" couplings for system pressure exceeding 400 psi, or approved equal.

3. Couplings shall be manufactured by Victaulic Co. of America, Tyler Pipe Industries Inc./Gustin-Bacon Division, or approved equal.

PIPE, FITTINGS, AND FLANGES SCHEDULE

SYSTEMS	PIPE	FITTINGS AND FLANGES
Wet-Pipe, Dry-Pipe, Deluge, Pre-Action, and Combined Dry-Pipe and Pre-Action Systems	Black Steel, ASTM A 120, A 53, or A 135, Schedule 40 (*)	A. Black Cast Iron, ANSI B16.4 or Malleable Iron, ANSI B16.3, 175 psi w.w.p., Threaded B. Companion Flanges, Cast Iron, ANSI B16.1, 125 lb. Class C. Ductible Iron, ASTM A 536, Roll-Grooved, Mechanical Type Couplings & Gaskets(*)
Any System where piping is subject to a corrosive environment or exposed to the weather; Water-Motor Gong Piping; Piping between Siamese Connection and Check Valve and Automatic Ball Drip Drain	Galvanized Steel, ASTM A 120 or A 53, Schedule 40	Galvanized Cast Iron, ANSI B16.4 or Galvanized Malleable Iron, ANSI B16.3, 175 psi w.w.p., Threaded
Drain Piping	Galvanized Steel, ASTM A 120 or A 53, Schedule 40	Galvanized Cast Iron (Drainage), ANSI B16.12, 125 lb. Class, Threaded
Piping at Sprinkler Water Meter Assembly	Galvanized Steel, ASTM A 120 or A 53, Schedule 40	Galvanized Cast Iron, ANSI B16.1, 125 lb. Class, Flanged

(*) Schedule 10 or lightweight steel pipe in accordance with NFPA 13 may be used for piping 2 inches and larger. Threaded or cut-grooved connections will not be permitted for this pipe.

2.02 VALVES

A. Control Valves

1. Valves

a. Valves shall be OS&Y, solid wedge gate valves with rising stem and wheel handles, rated for 175 psi w.w.p. Valves shall have gland followers in stuffing box and shall be repackable while open and under pressure.

b. Each valve shall be stamped with manufacturer's name and working pressure of the valve.

c. Valves, 2 inches and smaller, shall be threaded, bronze body.

d. Valves, 2 1/2 inches and larger, shall be flanged, iron body. Provide valved by-pass for valves 6 inches and larger.

e. Valves shall be manufactured by Crane Co., Walworth Co., Stockham Valves & Fittings, or approved equal.

2. Tamper Switches

a. Provide tamper switches in accordance with manufacturer's recommendations.

b. Tamper switches shall monitor the control valves to detect and indicate when a valve has been closed.

c. Unless otherwise shown on the Contract Drawings, tamper switches shall be completely factory assembled and wired and shall be mounted on the control valve. The valve stem shall be prepared as required to accept the actuating roller rod. Switches shall be Potter Electrical Signal Co. Model OSYS-B or OSYS-U, or approved equal.

d. Wiring to control circuit shall be as specified in Division 16.

e. Tamper switches shall be manufactured by Potter Electrical Signal Co., Acme Fire Alarm Co. Inc, Fire Control Instruments Inc., or approved equal.

B. Drain and Test Valves

1. Valves shall be threaded, bronze, angle or globe type with composition disc, 175 psi w.w.p.

2. At system low points where drain piping does not extend to a drain receptacle, provide a threaded hose end adapter at the valve outlet.

3. For dry-pipe systems, provide drum-drip drains on all low points in the systems. Enclose drum-drips in cabinets as shown on the Contract Drawings. Provide heating for drum-drip cabinets as shown on the Contract Drawings. Provide the drum-drip drains in protected locations. Extend auxiliary drains from drum-drips to the drain shown on the Contract Drawings.

4. The numbers and locations of drum-drips shown on the Contract Drawings are minimum; actual installation requirements and quantities shall be determined by the Contractor based on approved working drawings.

5. Valves shall be manufactured by Crane Co., Walworth Co., Stockham Valves & Fittings, or approved equal.

C. Check Valves

1. Check valves shall be swing type with renewable composition disc, bronze seat ring, and bolted cover.

2. Valves, 2 inches and smaller, shall be threaded, bronze, 175 psi w.w.p.

3. Valves, 2 inches and larger, shall be flanged, iron body, 175 psi w.w.p., unless otherwise shown on the Contract Drawings.

4. Valves shall be manufactured by Crane Co., Walworth Co., Stockham Valve & Fittings, or approved equal.

D. Sprinkler System Automatic Valves

1. General

a. Size of automatic valve (except for deluge system deluge valves) shall be at least as large as the system riser and related to system demand and friction loss limitations in hydraulically designed systems.

b. Automatic valves shall be manufactured by Reliable Automatic Sprinkler Co. Inc., Star Sprinkler Corp., Viking Corp., or approved equal.

2. Wet-Pipe Alarm Valves

   a. Alarm check valves shall be complete with all trimming including, but not limited to, retard chamber, water-motor gong, piping, fittings, electric alarm switch, drip cup, valves, pressure gauges, sight glass, etc.

   b. Alarm valves shall be Reliable "Model E" with "Model E-1" trimmings, or approved equal.

3. Dry-Pipe System or Combined Dry-Pipe and Pre-Action System Dry-Pipe Valves

   a. Dry-pipe valves shall be complete with all trimmings including, but not limited to, piping, fittings, electric alarm switch, priming chamber and fill lines, pressure gauge, and quick-opening devices as required by NFPA 13.

   b. Dry-pipe valve shall be Reliable "Model A" for 2 1/2-inch size and "Model D" for 4- and 6-inch sizes, or approved equal. Provide "Model A-2" automatic air maintenance device or approved equal, when compressed air is supplied from the building air supply.

   c. Provide an air compressor capable of filling the largest system to 40 psi within a period of 30 minutes, complete with Reliable "Model B-1" automatic air maintenance device, or approved equal.

4. Pre-Action System Deluge Valves

   a. Deluge valve shall be complete with all trimming including, but not limited to, piping, valves, fittings, electric alarm switch, alarm gauges, pilot trim, etc.

   b. Deluge valve shall be Reliable "Model A" for 2 1/2-inch size and "Model BX" with external reset for 4- and 6-inch sizes, or approved equal.

   c. Provide a self-contained supervisory air compressor panel. The panel shall supply approximately 24 oz./square in. air pressure and sound an alarm when pressure drops below 16 oz./square in. Panel shall be Reliable "Model B", or approved equal.

   d. Deluge system shall be controlled by an approved detection and actuation system (smoke, thermal, infrared, ultra-violet).

5. Deluge System Deluge Valves

a. Deluge valves shall be of the differential type, depending upon water pressure in the diaphragm chamber to hold the clapper closed against the water supply pressure. The valve shall be Reliable "Model A" for 2 1/2-inch size and "Model BX" with external reset for 4- and 6-inch sizes, or approved equal.

b. The valve shall have approved trim and shall have actuation means shown on the Contract Drawings.

2.03 SIAMESE CONNECTIONS

A. Siamese connections shall be two-way type, having a brass body, with clapper valves, hose thread swivels and painted plugs as required by local code, with brass chains or breakable caps and shall be Potter-Roemer Series 5950 or 5953, or approved equal. Siamese connection escutcheon shall be lettered in accordance with code requirements. Threads shall conform to local fire department requirements.

B. Where automatic ball drip is shown on the Contract Drawings to extend to the exterior at the siamese connection location, the siamese connection escutcheon shall be modified with a sillcock flange. In lieu of a sillcock flange, a drain elbow may be provided.

C. Flush type siamese connection shall be Potter-Roemer Series 5020, or approved equal. Size and location of outlet shall be as shown on the Contract Drawings. Extra-heavy nipple extensions shall be installed to connect the yoke to the outside assembly.

D. Exposed type siamese connection shall be Potter-Roemer Series 5720 or 5730, or approved equal. Size and location of outlet shall be as shown on the Contract Drawings.

E. Finish of siamese connection assembly including escutcheon shall be polished brass unless otherwise shown on the Contract Drawings.

F. Siamese connections shall be manufactured by Potter-Roemer Inc., Elkhart Brass Manufacturing Co. Inc., or approved equal.

2.04 ALARM ACTUATING DEVICES

A. All water flow signal devices shall be of the pressure activated type provided with sprinkler system automatic valve. Vane type water flow devices may be used in zoned sections of sprinkler systems.

B. All pressure operated water flow alarm devices and vane-type switches shall be provided in accordance with manufacturer's recommendations, be completely factory assembled, piped and wired to meet the field conditions. Wiring to control circuit shall be as specified in Division 16.

C. Water flow devices of the vane type shall have adjustable pneumatic retard to prevent alarm signals due to surges and two single-pole, double-throw microswitches. Water flow devices shall be Potter Electrical Signal Co. switch or switch/transmitter type, or approved equal.

D. The vane type device shall be provided a minimum of 18 inches from any flange, elbow, check valve or other fitting to minimize water surges and flow turbulence.

E. Tamper Switches are specified in 2.02 A.2.

2.05 FIRE LINE WATER METERS

Meter size shall be as shown on the Contract Drawings. The meter shall be set horizontally, dial facing upward not more than three feet above floor, properly supported and installed in accordance with the regulations of the local municipal water company. Meter register shall be straight reading in cubic feet capacity.

2.06 SPRINKLER HEADS

A. Sprinkler heads shall have 1/2-inch orifice and ordinary temperature rating (160-165 degrees F), unless otherwise shown on the Contract Drawings.

B. Sprinkler heads in areas without hung ceiling shall be bronze, upright or pendent type, Reliable "Model G", or approved equal.

C. Sprinkler heads in hung ceilings, where shown on the Contract Drawings, shall be chrome-plated, flush pendent type, Reliable "Model B" with chrome-plated escutcheon, or approved equal.

D. Sprinkler heads in hung ceilings, where shown on the Contract Drawings, shall be chrome-plated, recessed type, Reliable "Model G", or approved equal.

E. Sprinkler heads in hung ceilings, where shown on the Contract Drawings, shall be chrome-plated, concealed type, Reliable "Model G1", or approved equal.

F. Sprinkler heads for dry-pipe system provided in areas without hung ceilings shall be bronze, closed fusible link upright type, Reliable "Model G", or approved equal.

G. Sprinkler heads for dry-pipe system concealed within hung ceiling shall be chrome-plated, pendent dry type, Reliable "Model A" with chrome-plated escutcheon, or approved equal.

H. Sprinkler heads for concealed sidewall locations shall be polished, chrome-plated bronze type, Central "Omega" with chrome-plated recessed escutcheon, or approved equal.

I. Sprinkler heads for exposed sidewall locations shall be polished, chrome-plated bronze type, Reliable "Model G" with "Type B" chrome-plated escutcheon, or approved equal.

J. Provide sprinkler guards, Reliable "Model B" with a red enamel finish or approved equal, for pendent and upright heads to be installed in areas where the sprinkler head is subject to damage.

K. Sprinkler heads and guards shall be manufactured by Reliable Automatic Sprinkler Co. Inc., Star Sprinkler Corp., Viking Corp., or approved equal.

2.07 ACCESSORIES

A. Automatic Ball Drips

For each siamese connection and wherever shown on the Contract Drawings, provide a Potter-Roemer Model 5982 automatic ball drip, or approved equal. Provide pipe discharge to exterior or a drain receptacle. Where static pressure at location requiring drainage exceeds the ball drip operating characteristics, a valved drain shall be used.

B. Pressure Gauges

Gauges shall have cast iron case, 4 1/2-inch diameter aluminum ring-bronze bourdon tube, all brass linkage, 1/2-inch bottom connection, black pointer, white face with black figures and segment range of 0-200 psi, 20 psi figure intervals, 2 psi intermediate graduations. Dial shall have red marker at 175 psi. Gauges shall be Dresser Industries Inc. "Ashcroft Series 1079", or approved equal.

C. Sight Glass

1. Where test connections connect to closed drains or spill to receptacles located remotely from test control valves, a sight test connection, having a smooth bore noncorrosive orifice giving a flow equivalent to one sprinkler, shall be provided.

2. Where sprinkler drain lines connect to closed drain lines or spill to receptacles located remotely from drain valve, a glass sight drain shall be provided.

D. Water-Motor Gong

Water-motor gong shall be provided for exterior building wall as required. Miscellaneous framing shall be installed to secure gong rigidly as required. Water-motor gong shall be a minimum of 10 inches in diameter and shall be mounted on the exterior wall in accordance with the manufacturer's recommendations. Water-motor gong shall be Reliable "Model C", or approved equal.

E. Pipe and Valve Identification

1. Adhesive Bands

a. Provide approved adhesive bands in sets of two, one identifying the piping system type and the second, the direction of flow. Sets shall be provided in quantities sufficient to accommodate the requirements of 3.05 A of this Section.

b. For 3-inch or larger pipe, the adhesive band identifying the piping system shall display the name of the service in white letters at least two inches high and the band indicating direction of flow shall display a white arrow of similar size. For 2 1/2-inch or smaller pipe, the letters and the arrow shall be white and shall be not less than one inch high. Bands shall have red backgrounds and shall conform to ANSI A13.1.

c. Adhesive bands shall be W.H. Brady Co. "Quik-Label", or approved equal.

2. Valve Tags, Charts and Schedules

a. Provide each valve with a 2-inch diameter brass tag with brass chain.

b. Provide diagrammatic valve charts and schedules, using a valve numbering system which differentiates between classes of service and indicates floor level of valve location.

c. Tags shall conform to the numbers, locations, and uses listed in the valve charts and schedules.

d. Valve charts and schedules shall be mounted under glass in wood frames or aluminum self-closing frames.

e. Tags and the frames for valve charts and schedules shall be manufactured by Seton Name Plate Corp., or approved equal.

3. Identification Signs

a. Provide identification signs for all control valves, test valves, and system drain valves in accordance with NFPA 13. Identification signs shall be Reliable Style A and B, or approved equal.

b. On the outside of doors to rooms where control valves are located, provide suitable signs making note of such valve locations.

c. For hydraulically designed systems, a hydraulic calculation data sign shall be mounted at the system control valve assembly. The sign shall contain such data as design density, designed area of discharge, discharge rate, residual pressure available and pressure required.

F. Access Ladders

Control valves located seven feet or more above the finished floor shall be provided with a permanent steel access ladder. Ladder construction shall be approved by the Engineer.

G. Access Doors

Provide a complete list of all access doors required in finished walls, ceilings, partitions, and any other area for access to all valves, waterflow alarms, flushing connections, drains, etc., concealed behind such finished construction. Access doors shall be furnished and installed under other Sections.

2.08 PIPE HANGERS AND SUPPORTS

A. Design, fabricate and provide all pipe hangers and supports adequate to support and guide the piping, allow for forces imposed by expansion joints, satisfy structural requirements and maintain proper clearances with respect to adjacent piping, equipment and structures.

B. Provide hangers and supports, with beam clamps, restraints, supplemental steel, inserts, fish plates, mounting devices, and similar items to support piping in alignment without sagging or interference, and to permit complete drainage and free expansion and contraction.

C. All hangers and supports shall be capable of screw adjustment after piping is erected and shall be provided with a locking nut (double nut) to prevent loss of adjustment.

D. Where required, provide anchors, sway bracing, blocking and steel to connect to structure to prevent excessive pipe movement that could cause damage due to expansion, contraction or thrust.

E. All pipe hangers, inserts, supports, supplemental steel, rods, and components shall be galvanized.

F. Pipe hanger spacing, rod diameter, etc., shall be in accordance with the requirements of NFPA 13.

G. Support hangers from building steel framing wherever possible. Provide any additional miscellaneous steel supports between existing framing members as required. Do not support piping from other piping, ductwork and conduit.

H. Tabs in metal deck construction shall not be used to support piping.

I. Perforated band iron, strap iron or wire are not acceptable materials to be used and will not be approved.

J. Where required, provide supplemental channels and steel to support Work specified in this Section. Cut ends of steel shall be ground smooth, free from burrs and sprayed with a galvanized coating.

K. Where several pipes rest on a common trapeze, increase hanger rod diameter and decrease spacing in accordance with maximum and minimum pipe sizes, respectively.

L. Expansion anchors, self-drilling expansion shields, power driven studs and similar devices shall not be used, unless specifically approved by the Engineer.

M. Provide pipe restraints to prevent movement by an upward thrust in the pipe risers.

N. Support vertical piping at the lowest level, at each alternate level above and below offsets, and at the top of the riser by use of riser clamps. Provide additional intermediate support brackets, secured to structure, on piping utilizing gasket coupling joints.

O. Support horizontal piping as follows:

1. For piping 3 inches and smaller, support on adjustable swivel pipe rings or clevis type hangers.

2. For piping sizes of 4 to 8 inches, support on clevis type hangers.

3. For piping 10 inches and larger, support on trapeze hangers constructed of channel iron and hung from rod and insert assembly. Load calculations shall be performed.

P. Hanger system shall not penetrate waterproofing.

Q. If removal of existing fireproofing is required for installation purposes, such removal shall be performed by the Contractor and shall be kept to a minimum. The Contractor shall replace all removed fireproofing with new fireproofing to the satisfaction of the Engineer at no additional cost to the Authority.

R. Unless otherwise specifically approved, hanger rod size and spacing shall be within the following limits:

Pipe Size	Max. Hanger Spacing	Minimum Rod Size
2 1/2" to 3 1/2"	12 ft. o.c.	1/2"
4" and 5"	12 ft. o.c.	5/8"
6"	12 ft. o.c.	3/4"
8"	12 ft. o.c.	7/8"
10" and 12"	12 ft. o.c.	7/8"

S. Provide thrust restraint on underground piping entering the building through the floor or wall to serve the sprinkler systems.

T. Hangers and supports shall be manufactured by Grinnell Corp., Carpenter & Patterson Inc., Michigan Hanger Co. Inc., or approved equal.

2.09 SLEEVES, SEALS, AND ESCUTCHEONS

A. Piping passing through masonry or concrete walls and framed partitions shall have a trim opening cut no greater than necessary for the installation of a sleeve secured therein. Sleeve shall be 1/2 inch in diameter larger than the outside diameter of the pipe. Sleeve shall be flush with the finished wall or partition surface.

B. Sleeves through concrete floors for piping shall have the opening 1/2 inch in diameter larger than the outside diameter of the pipe passing through. Floor sleeves shall project one inch above floor slab.

C. Annular spaces between piping and sleeves shall be packed with mineral wool and sealed to retain the fire integrity of the walls, partitions, and floors with a nonhardening compound of Manville Corp., "Uniseal" or "Duxseal", or approved equal.

D. Sleeves in walls and floors shall be galvanized steel pipe, Schedule 40 for sizes up to 10 inches and 3/8-inch wall thickness for 12 inches and larger. Sleeves in partitions shall be 20-gauge galvanized sheet metal.

E. Piping in exposed areas, passing through walls, floors or ceilings shall be fitted with chromium-plated cast brass escutcheons with fastening set screws.

F. Piping passing through floor waterproofing membrane shall be provided with a 4-pound lead flashing or a 16-ounce copper flashing, each within an integral skirt or flange. Flashing shall be suitably formed, and the skirt or flange shall extend not less than 8 inches from the pipe and shall be set over the floor membrane in a solid coating of bituminous cement. The flashing shall extend up the pipe a minimum of 10 inches above the floor. The annular space between the flashing and the pipe shall be sealed watertight.

PART 3 - EXECUTION

3.01 INSTALLATION

A. General

1. Install piping and appurtenances in accordance with manufacturers' installation procedures, requirements of NFPA 13, and as specified.

2. Coordinate piping installation with other Work to avoid interference. Coordinate as necessary to ensure that all hangers, supports, sleeves and other built-in devices are incorporated in forms or in masonry to avoid necessity of cutting finished structure.

3. All measurements, both horizontal and vertical, shall be based on established bench marks. All Work shall agree with these established lines and levels. Verify all *measurements at site and check the correctness of same as* related to the Work.

4. Perform necessary cutting and patching in accordance with requirements specified in the Section entitled "CUTTING, PATCHING AND REMOVAL". All openings in existing slabs required for pipe penetrations shall be core drilled.

5. Electrical installation of appurtenances furnished under this Section shall be in accordance with requirements specified under Division 16.

6. Installation requirements for pipe hangers and supports and pipe penetration sleeves, seals, and escutcheons are specified in 2.08 and 2.09, respectively.

B. Piping

1. Install piping as shown on the Contract Drawings and straight and direct as possible, forming right angles or parallel lines with building walls, neatly spaced, with risers plumb and true.

2. Sprinkler piping shall be installed so that the system can be drained.

3. Avoid tool marks and unnecessary pipe threads. Burrs formed when cutting pipe shall be removed by reaming. Before installing pipe, thoroughly clean the inside free of cutting and foreign matter. Cut all pipe square and smooth and make up all joints to required limits.

4. Make changes in pipe size by the use of reducing fittings. Do not use reducing bushings except by approval of the Engineer.

5. Install piping so that no part thereof will interfere with doors, windows, heating, plumbing or electrical equipment. Coordinate Work specified in this Section with that specified in other Sections to avoid any interference with potential effectiveness of the automatic sprinkler systems.

6. Provide protective pans under pipes passing over high voltage electric bus duct or switchgear equipment. Construct the pans of 18-gauge copper, suitably reinforced to prevent sagging. Turn the edges of the pans up to 6 inches on all sides with corners brazed to make the pans watertight. Support the pan with hangers and provide drainage clear of the electrical work.

7. Provide flushing connections for flushing scale and foreign material from sprinkler system in accordance with NFPA 13.

8. Before final piping connections are made to equipment and before sprinkler heads are installed, all piping shall be thoroughly blown out, rodded out, or washed out at least twice, in a manner as directed and approved by the Engineer, to remove all accumulation of dirt, chips or other deleterious materials. Make all temporary connections and furnish all appliances required for the purpose of cleaning.

C. Pipe Joints

1. Threaded joints shall be made up tight using pipe joint Teflon compound or tape, applied on the male threads only.

2. Roll-grooved pipe and fittings shall be clean and free from indentations, projections and tool marks in the area from pipe end to groove for proper gasket sealing. Provide a thin uniform coat of lubricant on the suitable gasket intended for specified service as recommended by the manufacturer. Place the gasket over one pipe end, align pipe ends and bring together, positioning the gasket between the groove on each pipe end. Assemble the housing over the gasket with housing key section engaging both grooves. The bolts shall be inserted, nuts started and uniformly tightened until the housing bolt pads are firmly seated together, metal to metal.

3. Flanged joints shall be made up square and tight with gaskets. Dip bolts and nuts in mixture of graphite and oil immediately prior to installation.

4. Joints between copper or brass and steel pipe shall be made by using a dielectric coupling.

3.02 FIELD TESTS

A. Notify the Engineer and those authorities which would have jurisdiction, if this Contract were being performed for a private corporation, at least 48 hours in advance of making the required tests, so that arrangements may be made for their presence to witness the tests.

B. Perform all tests prior to painting or concealing.

C. Isolate all equipment, controls and instruments from the piping system during the required tests.

D. Provide and install necessary equipment, instruments, hardware, temporary piping, vents, drains, and include necessary personnel required to perform all tests.

E. Perform hydrostatic tests for all sections of the piping systems installed under this Section, at not less than 200 psi pressure for two hours, or at 50 psi in excess of the maximum pressure, when the maximum pressure to be maintained in the system is in excess of 150 psi. The test pressure shall be read from a gauge located at the low elevation point of the individual system or portion of the system being tested.

F. Test dry-pipe system with air at 40 psi for 24 hours, prior to performing the hydrostatic tests specified in 3.02 D above. Permissible air leakage shall not exceed the value specified in NFPA 13.

G. Systems may be tested in sections, when directed by the Engineer, to permit construction to proceed. Testing on a section-by-section basis may be done with standard air pressure test. When the sprinkler system is completely installed, it shall be subjected to the hydrostatic test herein specified.

H. Test all components in the system including alarm devices and demonstrate that the equipment complies with the requirements and function for which they are intended. Testing through the Inspector's Test Connection shall be included to demonstrate that flow and time parameters are satisfied.

I. With the entire system under normal operating pressure, each control valve shall be opened and closed to demonstrate proper operation.

J. All tests shall conform to the requirements of NFPA 13. Records of all tests shall be made available for the Engineer's inspection, as required.

K. Should the tests reveal any leaks or deficiencies in piping installed under this Section, make necessary corrections immediately and flush, clean and retest the system for the Engineer's approval at no cost to the Authority.

L. Repair or replace any portion of the system installed under this Section that is damaged as a result of test operations at no cost to the Authority.

M. Where piping installed under this Section is connected to any existing system, such installed piping shall be isolated from the existing system during the performance of the required field tests, unless otherwise directed by the Engineer.

N. The Engineer reserves the right to direct the Contractor not to isolate the newly-installed piping from from the existing system during the performance of the required field tests. In such event, the Contractor shall correct any revealed leaks or other deficiencies within the first 20 feet of the existing system, measured in any direction from the point of connection with the newly installed piping, all as directed by the Engineer and at no additional cost to the Authority.

O. Dispose of water removed from pipelines in a manner that shall not cause damage to any property.

3.03 PROTECTION

As soon as sprinkler heads are in place, cover each head with a small paper bag of a UL-approved type which shall be removed only after all painting is complete and then all heads shall be cleaned.

3.04 PAINTING

Upon completion of the installation, remove all protecting materials, thoroughly remove all scale and grease and leave in a clean condition for painting. Piping to be painted shall be as shown on the Contract Drawings. Painting is specified in other Sections of the Specifications.

3.05 PIPE AND VALVE IDENTIFICATION

A. Pipe Identification

Affix sets of pipe adhesive bands specified in 2.07 E.1 where they can be easily read, with their long dimension parallel to the axis of the pipe and no more than 40 feet apart on a piping system.

At least one set of identifying bands shall be affixed in all occupied and unoccupied rooms as well as in all other spaces, such as hung ceilings or shafts, where piping may be viewed and the identity of the piping system cannot be readily ascertained.

B. Valve Tags

Securely fasten valve tags specified in 2.07 E.2 with approved brass chain.

END OF SECTION

SECTION 15375

FIRE STANDPIPE SYSTEM

PIPING AND APPURTENANCES

PART 1 - GENERAL

1.01 SUMMARY

This Section specifies requirements of piping and appurtenances for the fire standpipe systems.

1.02 REFERENCES

(Not Used)

1.03 DESIGN AND PERFORMANCE REQUIREMENTS

A. Design and performance of components and methods specified herein shall comply with the applicable provisions of the codes, standards, recommendations of the entities listed below:

New York City Building Code

New York City Board of Standards and Appeals

The BOCA Basic Building Code

The BOCA Basic Fire Prevention Code

City of Yonkers Building Code

Municipal Water Company

American National Standards Institute (ANSI)

American Society for Testing and Materials (ASTM)

American Water Works Association (AWWA)

Factory Mutual Research Corp. (FM)

National Fire Protection Association (NFPA)

Underwriters Laboratories Inc. (UL)

In addition, specific provisions cited herein shall govern for the associated specific application.

B. The fire standpipe systems shall be designed in accordance with NFPA 14 and the design shall be based on water supply information as shown on the Contract Drawings or, if not shown, as determined by a water flow test by the Contractor.

C. Fire standpipe system piping and appurtenances shall be UL listed and approved by FM and those authorities which would have jurisdiction, if this Contract were being performed for a private corporation, as applicable.

1.04 QUALITY ASSURANCE

A. Fire standpipe system piping and appurtenances, of types and sizes required, shall have been satisfactorily used for purposes similar to those intended herein for not less than three years.

B. Entities performing Work shall have experience on at least two projects involving complexities similar to those required under this Contract.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Clean all pipe sections of foreign matter and cover ends with temporary sheet metal closures or plastic end caps of sufficient tightness to prevent entry of foreign matter prior to shipping to the construction site.

B. Store pipe, fittings, valves and other components at the construction site on pallets or raised platforms with suitable coverings satisfactory to the Engineer to protect them against damage and weather.

C. Inspect all pipe, fittings, valves and other components for damage before moving them from storage to the point of installation at the construction site.

1.06 SUBMITTALS

A. Submit the following in accordance with the requirements of "Shop Drawings, Catalog Cuts, and Samples" of Division 1 - GENERAL PROVISIONS:

1. Detailed piping layout drawing, including hanger and support locations and details, with load calculations where required

2. Electrical wiring diagrams

3. Catalog cuts for the following:

   a. Hose stations
   b. Fittings and flanges
   c. Valves
   d. Tamper switches
   e. Hangers and supports
   f. Sleeves and escutcheons
   g. Valve tags and pipe identification bands
   h. Pressure gauges
   i. Siamese connections
   j. Adjustable pressure restricting devices
   k. Other specialty items specified in this Section

4. Piping material and schedule for each piping system

5. Valve charts and schedules

6. Access ladder drawings

7. List of access doors

B. Submit operation and maintenance manuals, including replacement and spare parts lists for fire standpipe systems.

C. Submit field test results.

PART 2 - PRODUCTS

2.01 PIPE, FITTINGS, AND FLANGES

A. Provide pipe, fittings, and flanges in accordance with the "PIPE, FITTINGS, AND FLANGES SCHEDULE" specified below, including gaskets, bolts, nuts, washers and other pressure containing parts necessary for the complete installation of piping systems.

B. Nipples shall be extra-heavy shoulder type of same material as pipe; close nipples are not acceptable.

C. Gaskets for flanges shall be 1/16-inch thick (after compression), rubber or neoprene, full-faced, and punched bolt holes.

D. Grooved Piping Mechanical Couplings

1. Couplings shall be complete with gaskets, bolts and nuts recommended by the manufacturer for the service. Use vandalproof nuts and bolts on vertical piping in stairs.

2. Couplings shall be Victaulic "Style 75" lightweight for system pressure not exceeding 400 psi (including shut-off pressure of fire pump and static street pressure of water main) and Victaulic "Style 77" for system pressure exceeding 400 psi, or approved equal.

3. Couplings shall be manufactured by Victaulic Co. of America, Tyler Pipe Industries Inc./Gustin-Bacon Division, or approved equal.

PIPE, FITTINGS, AND FLANGES SCHEDULE

SYSTEMS	PIPE	FITTINGS AND FLANGES
Wet Standpipe	Black Steel, ASTM A 120, A 53, or A 135, Schedule 40	A. Black Malleable Iron, ANSI B16.3 or Ductile Iron AWWA C110, 300 lb. Class, 500 psi w.w.p., Threaded B. Companion Flanges, Cast Iron, ANSI B16.1, 125 lb. Class C. Ductile Iron ASTM A 536, Grooved, Mechanical Type Couplings and Gaskets
Dry Standpipe, or piping subject to corrosion; Piping between Siamese connection and Check Valve and Automatic Ball Drip Drain	Galvanized Steel, ASTM A 120 or A 53, Schedule 40	Same as for Wet Standpipe except all fittings and flanges shall be galvanized.
Drain Piping	Galvanized Steel, ASTM A 120 or A 53, Schedule 40	Galvanized Cast Iron (Drainage), ANSI B16.12, 125 lb. Class, Threaded.
Piping at Standpipe Water Meter Assembly	Galvanized Steel, ASTM A 120 or A 53, Schedule 40	Galvanized Cast Iron, ANSI B16.1, 125 lb. Class, Flanged.

2.02 VALVES

A. Control Valves

1. Valves

a. Valves shall be flanged, iron body, bronze mounted, OS&Y, solid wedge gate valves with rising stem and wheel handles, rated for 175 psi w.w.p. and as shown on the Contract Drawings. Valves shall have gland followers in stuffing box and shall be repackable while open and under pressure. Provide valved by-pass around valves six inches and larger.

b. Valves shall be manufactured by Crane Co., Walworth Co., Stockham Valves & Fittings, or approved equal.

2. Tamper Switches

a. Provide tamper switches in accordance with manufacturer's recommendations.

b. Tamper switches shall monitor the control valves to detect and indicate when a valve has been closed.

c. Unless otherwise shown on the Contract Drawings, tamper switches shall be completely factory assembled and wired and shall be mounted on the control valve. The valve stem shall be prepared as required to accept the actuating roller rod. Switches shall be Potter Electrical Signal Co. Model OSYS-B or OSYS-U, or approved equal.

d. Wiring to control circuit shall be as specified in Division 16.

e. Tamper switches shall be manufactured by Porter Electric Signal Co., Acme Fire Alarm Co. Inc., Fire Control Instruments Inc., or approved equal.

B. Drain Valves (Dry Systems)

1. Valves shall be threaded, bronze, angle or globe type with composition disc, 200 psi w.w.p.

2. At system low points where drain piping does not extend to a drain receptacle, provide a threaded hose end adapter at the valve outlet.

3. For dry standpipe system to be filled with compressed air, provide drum-drip drains on all low points in the systems. Enclose drum-drips in cabinets as shown on the Contract Drawings. Provide heating for drum-drip cabinets as shown on the Contract Drawings. Provide the drum-drip drains in protected locations. Extend auxiliary drains from drum-drips to the drain shown on the Contract Drawings.

4. The numbers and locations of drum-drips shown on the Contract Drawings are minimum; actual installation requirements and quantities shall be determined by the Contractor based on approved shop drawings.

5. Valves shall be manufactured by Crane Co., Walworth Co., Stockham Valves & Fittings, or approved equal.

C. Check Valves

1. Check valves shall be swing type, flanged, iron body, bronze mounted with renewable composition disc, bronze seat ring, and bolted cover, rated for 175 psi w.w.p. and as shown on the Contract Drawings.

2. Valves shall be manufactured by Crane Co., Walworth Co., Stockham Valve & Fittings, or approved equal.

D. Dry Standpipe System Automatic Valves

1. For dry fire standpipe system, activation shall occur through one of the applicable automatic valves specified below and as shown on the Contract Drawings:

a. Deluge valve shall be electrically-operated, release type with manual trip device complete with all drains, accessories, and controls. Deluge valve shall be operational from electrically-operated, remote control stations located at each hose rack. All drains shall be connected and discharged into the drain receptor. Valve shall be Star Sprinkler "Model D", or approved equal. Controls, switches, panels, alarms, etc. shall be as specified in Division 16.

b. Dry-pipe valve shall be of the differential type, only. The dry-pipe valve shall be furnished with bronze clapper and latch and shall be Star Sprinkler "Model B", or approved equal.

c. Provide opening device on all systems. The device shall be of the exhauster pattern, designed and installed so as to provide for a full 2 inches air release from the system and designed to operate upon a 2 psi differential pressure within 7 seconds after fully opening the standard test connections. Exhauster shall be Star Sprinkler "Model BB", or approved equal.

2. Automatic valves shall be manufactured by Reliable Automatic Sprinkler Co. Inc., Star Sprinkler Corp., Viking Corp., or approved equal.

2.03 SIAMESE CONNECTIONS

A. Siamese connections shall be two-way type, having a brass body, with clapper valves, hose thread swivels and red painted plugs, as required by local code, with brass chains or breakable caps and shall be Potter-Roemer Series 5950 or 5953, or approved equal. Siamese connection escutcheon shall be lettered in accordance with code requirements. Threads shall conform to local fire department requirements.

B. Where automatic ball drip is shown on the Contract Drawings to extend to the exterior at the siamese connection location, the siamese connection escutcheon shall be modified with a sillcock flange. In lieu of a sillcock flange, a drain elbow may be provided.

C. Flush type siamese connection shall be Potter-Roemer Series 5020, or approved equal. Size and location of outlet shall be as shown on the Contract Drawings. Extra-heavy nipple extensions shall be installed to connect the yoke to the outside assembly.

D. Exposed type siamese connection shall be Potter-Roemer Series 5720 or 5730, or approved equal. Size and location of outlet shall be as shown on the Contract Drawings.

E. Finish of siamese connection assembly including escutcheon shall be polished brass unless otherwise shown on the Contract Drawings.

F. Siamese connections shall be manufactured by Potter-Roemer Inc., Elkhart Brass Manufacturing Co. Inc., or approved equal.

2.04 FIRE LINE WATER METERS

Meter size shall be as shown on the Contract Drawings. The meter shall be set horizontally, dial facing upward not more than three feet above floor, properly supported and installed in accordance with the regulations of the local municipal water company. Meter register shall be straight reading in cubic feet capacity.

2.05 FIRE HOSE STATIONS

A. All the fire standpipe equipment numbers specified herein are those of Potter-Roemer Inc.

B. Hose Racks (2 1/2-inch Valve with 1 1/2-inch Hose)

At each hose station, exposed or in a hose cabinet, where shown on the Contract Drawings, provide a Figure (Fig.) 4075, 2 1/2-inch brass angle valve, complete with 2 1/2-inch brass rack supporting hose nipple, a Fig. 2810, 2 1/2-inch x 1 1/2-inch reducer, with 1 1/2-inch Fig. 2915, Polyflex synthetic fire hose (length of hose is shown on the Contract Drawings, in 25 or 50 foot sections); Fig. 2934, satin cast brass expansion ring couplings attached; straight stream nozzles of Lexan plastic or galvanized iron; Fig. 2793, all steel, red enameled hose rack with non-detachable sliding pins and spring clip nozzle holder and trigger mechanism; and Fig. 6057, Universal Spanner with brass chain.

C. Hose Racks (2 1/2-inch Valve with 2 1/2-inch Hose)

At each hose station, exposed or in a hose cabinet, where shown on the Contract Drawings, provide a Fig. 4075, 2 1/2-inch brass angle valve, complete with 2 1/2-inch brass rack supporting hose nipple, with 2 1/2-inch Fig. 2916, Polyflex synthetic fire hose (length of hose is shown on the Contract Drawings, in 25 or 50 foot sections); Fig. 2936, satin cast brass expansion ring couplings attached; straight stream nozzles of Lexan plastic or galvanized iron; Fig. 2887, all steel, red enameled hose rack with non-detachable sliding pins and spring clip nozzle holder and trigger mechanism; and Fig. 6057, Universal Spanner with brass chain.

D. Hose Cabinets

Selection of hose cabinet shall be as shown on the Contract Drawings and shall conform to the applicable description specified below:

1. Hose Cabinets (Recessed/Space for Extinguisher)

Cabinet for hose station and extinguisher shall be Fig. 1300 Series for 1 1/2-inch valve (Fig. 1400 Series for 2 1/2-inch valve), recessed cabinet with 20-gauge steel body and 18-gauge trim, having 20-gauge door of style "AW" Full Panel wire glass. Cabinet shall be white enamel inside and prime coated outside.

2. Hose Cabinets (Surface-Mounted/Space for Extinguisher)

Cabinet for hose station and extinguisher shall be Fig. 1350 Series for 1 1/2-inch valve (Fig. 1450 Series for 2 1/2-inch valve), surface-mounted cabinet with 20-gauge steel body and trim, having 20-gauge door of style "AW" Full Panel wire glass. Cabinet shall be white enamel inside and prime coated outside.

3. Hose Cabinets (Recessed/No Space for Extinguisher)

Cabinet for hose station shall be Fig. 1000 Series for 1 1/2-inch valve (Fig. 1100 Series for 2 1/2-inch valve), recessed cabinet with 20-gauge steel body and 18-gauge trim having 20-gauge door of style "DW" Duo Panel wire glass. Cabinet shall be white enamel inside and prime coated outside.

4. Hose Cabinets (Surface-Mounted/No Space for Extinguisher)

Cabinet for hose station shall be Fig. 1050 Series for 1 1/2-inch valve (Fig. 1150 Series for 2 1/2-inch valve), surface-mounted cabinet with 20-gauge steel body and trim, having 20-gauge door of style "DW" Duo Panel wire glass. Cabinet shall be white enamel inside and prime coated outside.

5. Valve Cabinets (2 1/2-inch Valve)

Hose valve cabinet for recessed or surface-mounted use shall be Fig. 1800 Series with 20-gauge steel body, 18-gauge trim having 20-gauge door of style "AW" Full Panel wire glass. Cabinets shall accommodate 2 1/2-inch angle valve with cap and chain and shall be white enamel inside and prime coated outside.

E. Adjustable Pressure Restricting Devices

Provide Fig. 2766, 2 1/2-inch, brass, suitable outlet pressure reducer where hydrostatic pressure exceeds 85 psi for 1 1/2-inch hose and 55 psi for 2 1/2-inch hose.

F. Fire Extinguisher Cabinets (All)

Fire extinguisher cabinet for recessed or surface-mounted use shall be Fig. 1700 Series with 22-gauge steel body, 18-gauge trim having tubular door of style "AW" Full Panel wire glass. Cabinet shall be of size to accommodate extinguisher type, as shown on the Contract Drawings, and shall be white enamel inside and prime coated outside.

G. Roof Manifolds

Size and position of roof manifold shall be as shown on the Contract Drawings and shall be Fig. 5890 Series vertical, or Fig. 5880 Series horizontal, complete with three Fig. 4065, 2 1/2-inch brass valves with Fig. 4625 brass caps and chains.

H. Fire standpipe equipment shall be manufactured by Potter-Roemer Inc., Elkhart Brass Manufacturing Co. Inc., or approved equal.

2.06 ACCESSORIES

A. Automatic Ball Drips

For each siamese connection and wherever shown on the Contract Drawings, provide a Potter-Roemer Model 5982 automatic ball drip, or approved equal. Provide pipe discharge to exterior or a drain receptacle. Where static pressure at location requiring drainage exceeds the ball drip operating characteristics, a valved drain shall be used.

B. Pressure Gauges

Gauges shall have cast iron case, 4 1/2-inch diameter aluminum ring-bronze bourdon tube, all brass linkage, 1/2-inch bottom connection, black pointer, white face with black figures and segment range of 0-200 psi, 20 psi figure intervals, 2 psi intermediate graduations. Dial shall have red marker at 175 psi. Gauges shall be Dresser Industries Inc. "Ashcroft Series 1079", or approved equal.

C. Pipe and Valve Identification

1. Adhesive Bands

a. Provide approved adhesive bands in sets of two, one identifying the piping system type and the second, the direction of flow. Sets shall be provided in quantities sufficient to accommodate the requirements of 3.04 A of this Section.

b. For 3-inch or larger pipe, the adhesive band identifying the piping system shall display the name of the service in white letters at least two inches high and the band indicating direction of flow shall display a white arrow of similar size. For 2 1/2-inch or smaller pipe, the letters and the arrow shall be white and shall be not less than one inch high. Bands shall have red backgrounds and shall conform to ANSI A 13.1.

c. Adhesive bands shall be W. H. Brady Co. "Quik-Label", or approved equal.

2. Valve Tags, Charts and Schedules

a. Provide each valve with a 2-inch diameter brass tag with brass chain.

b. Provide diagrammatic valve charts and schedules, using a valve numbering system which differentiates between classes of service and indicates floor level of valve location.

c. Tags shall conform to the numbers, locations and uses listed in the valve charts and schedules.

d. Valve charts and schedules shall be mounted under glass in wood frames or aluminum self-closing frames.

e. Tags and the frames for valve charts and schedules shall be manufactured by Seton Name Plate Corp., or approved equal.

3. Identification Signs

a. Provide identification signs for control valves. Identification signs shall be Reliable Style A and B, or approved equal.

b. On the outside of doors to rooms where control valves are located, provide suitable signs making note of such valve locations.

D. Access Ladders

Control valves located seven feet or more above the finished floor shall be provided with a permanent steel access ladder. Ladder construction shall be approved by the Engineer.

E. Access Doors

Provide a complete list of all access doors required in finished walls, ceilings, partitions, and any other areas for access to all valves and drains concealed behind such finished construction. Access doors shall be furnished and installed under other Sections.

2.07 PIPE HANGERS AND SUPPORTS

A. Design, fabricate and provide all pipe hangers and supports adequate to support and guide the piping, allow for forces imposed by expansion joints, satisfy structural requirements and maintain proper clearances with respect to adjacent piping, equipment and structures.

B. Provide hangers and supports, with beam clamps, restraints, supplemental steel, inserts, fish plates, mounting devices, and similar items to support piping in alignment without sagging or interference, and to permit complete drainage and free expansion and contraction.

C. All hangers and supports shall be capable of screw adjustment after piping is erected and shall be provided with a locking nut (double nut) to prevent loss of adjustment.

D. Where required, provide anchors, sway bracing, blocking and steel to connect to structure to prevent excessive pipe movement that could cause damage due to expansion, contraction, or thrust.

E. All pipe hangers, inserts, supports, supplemental steel, rods, and components shall be galvanized.

F. Support hangers from building steel framing wherever possible. Provide any additional miscellaneous steel supports between existing framing members as required. Do not support piping from other piping, ductwork and conduit.

G. Tabs in metal deck construction shall not be used to support piping.

H. Perforated band iron, strap iron or wire are not acceptable materials to be used and will not be approved.

I. Where required, provide supplemental channels and steel to support Work of this Section. Cut ends of steel shall be ground smooth, free from burrs and sprayed with a galvanized coating.

J. Where several pipes rest on a common trapeze, increase hanger rod diameter and decrease spacing in accordance with maximum and minimum pipe sizes, respectively.

K. Expansion anchors, self-drilling expansion shields, power driven studs and similar devices shall not be used, unless specifically approved by the Engineer.

L. Provide pipe restraints to prevent movement by an upward thrust in the pipe risers.

M. Support vertical piping at the lowest level, at each alternate level above and below offsets, and at the top of the riser by use of riser clamps. Provide additional intermediate support brackets, secured to structure, on piping utilizing gasket coupling joints.

N. Support horizontal piping as follows:

1. For piping sizes of 3 to 8 inches, support on clevis type hangers.

2. For piping 10 inches and larger, support on trapeze hangers constructed of channel iron and hung from rod and insert assembly. Load calculations shall be performed.

O. Hanger system shall not penetrate waterproofing.

P. If removal of existing fireproofing is required for installation purposes, such removal shall be performed by the Contractor and shall be kept to a minimum. The Contractor shall replace all removed fireproofing with new fireproofing to the satisfaction of the Engineer and at no additional cost to the Authority.

Q. Unless otherwise specifically approved, hanger rod size and spacing shall be within the following limits:

Pipe Size	Max. Hanger Spacing	Minimum Rod Size
2 1/2" to 3 1/2"	12 ft. o.c.	1/2"
4" and 5"	12 ft. o.c.	5/8"
6"	12 ft. o.c.	3/4"
8"	12 ft. o.c.	7/8"
10" and 12"	12 ft. o.c.	7/8"

R. Provide thrust restraint on underground piping entering the building through the floor or wall to serve the fire standpipe systems.

S. Hangers and supports shall be manufactured by Grinnell Corp., Carpenter & Patterson Inc., Michigan Hanger Co. Inc., or approved equal.

2.08 SLEEVES, SEALS AND ESCUTCHEONS

A. Piping passing through masonry or concrete walls and framed partitions shall have a trim opening cut no greater than necessary for the installation of a sleeve secured therein. Sleeve shall be 1/2 inch in diameter larger than the outside diameter of the pipe. Sleeve shall be flush with the finished wall or partition surface.

B. Sleeves through concrete floors for piping shall have the opening 1/2 inch in diameter larger than the outside diameter of the pipe passing through. Floor sleeves shall project one inch above floor slab.

C. Annular spaces between piping and sleeves shall be packed with mineral wool and sealed to retain the fire integrity of the walls, partitions, and floors with a nonhardening compound of Manville Corp., "Uniseal" or "Duxseal", or approved equal.

D. Sleeves in walls and floors shall be galvanized steel pipe, Schedule 40 for sizes up to 10 inches and 3/8-inch wall thickness for 12 inches and larger. Sleeves in partitions shall be 20-gauge galvanized sheet metal.

E. Piping in exposed areas, passing through walls, floors or ceilings shall be fitted with chromium-plated cast brass escutcheons with fastening set screws.

F. Piping passing through floor waterproofing membrane shall be provided with a 4-pound lead flashing or a 16-ounce copper flashing, each within an integral skirt or flange. Flashing shall be suitably formed, and the skirt or flange shall extend not less than 8 inches from the pipe and shall be set over the floor membrane in a solid coating of bituminous cement. The flashing shall extend up the pipe a minimum of 10 inches above the floor. The annular space between the flashing and the pipe shall be sealed watertight.

PART 3 - EXECUTION

3.01 INSTALLATION

A. General

1. Install piping and appurtenances in accordance with manufacturers' installation procedures, requirements of NFPA 14, and as specified.

2. Coordinate piping installation with other Work to avoid interference. Coordinate as necessary to ensure that all hangers, supports, sleeves and other built-in devices are incorporated in forms or in masonry to avoid necessity of cutting finished structure.

3. All measurements, both horizontal and vertical, shall be based on established bench marks. All Work shall agree with these established lines and levels. Verify all measurements at site and check the correctness of same as related to the Work.

4. Perform necessary cutting and patching in accordance with requirements specified in the Section entitled "CUTTING, PATCHING AND REMOVAL". All openings in existing slabs required for pipe penetrations shall be core drilled.

5. Electrical installation of appurtenances furnished under this Section shall be in accordance with requirements specified under Division 16.

6. Installation requirements for pipe hangers and supports and pipe penetration sleeves, seals, and escutcheons are specified in 2.07 and 2.08, respectively.

B. Piping

1. Install piping as shown on the Contract Drawings and straight and direct as possible, forming right angles or parallel lines with building walls, neatly spaced, with risers plumb and true.

2. Avoid tool marks and unnecessary pipe threads. Burrs formed when cutting pipe shall be removed by reaming. Before installing pipe, thoroughly clean the inside free of cutting and foreign matter. Cut all pipe square and smooth and make up all joints to required limits.

3. Make changes in pipe size by the use of reducing fittings. Do not use reducing bushings except by approval of the Engineer.

4. Install piping so that no part thereof will interfere with doors, windows, heating, plumbing or electrical equipment. Coordinate Work specified in this Section with that specified in other Sections to avoid any interference with potential effectiveness of the fire standpipe systems.

5. Provide protective pans under pipes passing over high voltage electric bus duct or switchgear equipment. Construct the pans of 18-gauge copper, suitably reinforced to prevent sagging. Turn the edges of the pans up to 6 inches on all sides with corners brazed to make the pans watertight. Support the pan with hangers and provide drainage clear of the electrical work.

6. Dry systems shall be installed so that the system can be drained.

7. All piping shall be thoroughly blown out, rodded out, or washed out at least twice, in a manner as directed and approved by the Engineer, to remove all accumulation of dirt, chips or other deleterious materials. Make all temporary connections and furnish all appliances required for the purpose of cleaning.

C. Pipe Joints

1. Threaded joints shall be made up tight using pipe joint Teflon compound or tape, applied on the male threads only.

2. Grooved pipe and fittings shall be clean and free from indentations, projections and tool marks in the area from pipe end to groove for proper gasket sealing. Provide a thin uniform coat of lubricant on the suitable gasket intended for specified service as recommended by the manufacturer. Place the gasket over one pipe end, align pipe ends and bring together, positioning the gasket between the groove on each pipe end. Assemble the housing over the gasket with housing key section engaging both grooves. The bolts shall be inserted, nuts started and uniformly tightened until the housing bolt pads are firmly seated together, metal to metal.

3. Flanged joints shall be made up square and tight with gaskets. Dip bolts and nuts in mixture of graphite and oil immediately prior to installation.

4. Joints between copper or brass and steel pipe shall be made by using a dielectric coupling.

3.02 FIELD TESTS

A. Notify the Engineer and those authorities which would have jurisdiction, if this Contract were being performed for a private corporation, at least 48 hours in advance of making the required tests, so that arrangements may be made for their presence to witness the tests.

B. Perform all tests prior to painting or concealing.

C. Isolate all equipment, controls and instruments from the piping system during the required tests.

D. Provide and install necessary equipment, instruments, hardware, temporary piping, vents, drains, and include necessary personnel required to perform all tests.

E. Perform hydrostatic tests for all sections of the piping systems (except siamese connections), at not less than 200 psi pressure for two hours, or at 50 psi in excess of the maximum pressure, when the maximum pressure to be maintained in the system is in excess of 150 psi. Test pressure for siamese connections shall not be less than 300 psi. The test pressure shall be read from a gauge located at the lov elevation point of the individual system or portion of the system being tested.

F. Test dry-pipe systems with air at 40 psi for 24 hours, prior to performing the hydrostatic tests specified in 3.02 D above. Permissible air leakage shall not exceed the value specified in NFPA 14.

G. Set the adjustable pressure reducing devices according to the manufacturer's instructions to produce flows at the required rate and pressure in accordance with the applicable code requirements, as if this Contract were being performed for a private corporation. A written record shall be furnished to the Engineer of all settings throughout the system.

H. With the entire system under normal operating pressure, each control valve shall be opened and closed to demonstrate proper operation.

I. All tests shall conform to the requirements of NFPA 14. Records of all tests shall be made available for the Engineer's inspection, as required.

J. Should the tests reveal any leaks or deficiencies in piping installed under this Section, make necessary corrections immediately and flush, clean and retest the system for the Engineer's approval at no cost to the Authority.

K. Repair or replace any portion of the system installed under this Section that is damaged as a result of test operations at no cost to the Authority.

L. Where piping installed under this Section is connected to any existing system, such installed piping shall be isolated from the existing system during the performance of the required field tests, unless otherwise directed by the Engineer.

M. The Engineer reserves the right to direct the Contractor not to isolate the newly-installed piping from from the existing system during the performance of the required field tests. In such event, the Contractor shall correct any revealed leaks or other deficiencies within the first 20 feet of the existing system, measured in any direction from the point of connection with the newly installed piping, all as directed by the Engineer and at no additional cost to the Authority.

N. Dispose of water removed from pipelines in a manner that shall not cause damage to any property.

3.03 PAINTING

Upon completion of the installation, remove all protecting materials, thoroughly remove all scale and grease and leave in a clean condition for painting. Piping to be painted shall be as shown on the Contract Drawings. Painting is specified in other Sections of the Specifications.

3.04 PIPE AND VALVE IDENTIFICATION

A. Pipe Identification

Affix sets of pipe adhesive bands specified in 2.06 C.1 where they can be easily read, with their long dimension parallel to the axis of the pipe and no more than 40 feet apart on a piping system.

At least one set of identifying bands shall be affixed in all occupied and unoccupied rooms as well as in all other spaces, such as hung ceilings or shafts, where piping may be viewed and the identity of the piping system cannot be readily ascertained.

B. Valve Tags

Securely fasten valve tags specified in 2.06 C.2 with approved brass chain.

END OF SECTION

A 10/4/88

SECTION 15890

METAL DUCTWORK AND ACCESSORIES

PART 1 - GENERAL

1.01 SUMMARY

A. This Section specifies requirements for metal ductwork and accessories.

B. Ductwork accessories specified in this Section are:

Flexible Duct Connectors

Backdraft Dampers

Fire Dampers

Ceiling Dampers

Duct Access Doors

1.02 REFERENCES

(Not used)

1.03 DESIGN AND PERFORMANCE REQUIREMENTS

Design and performance of components and methods specified herein shall comply with the applicable provisions of the codes, standards, recommendations of the entities listed below.

New York City Building Code Reference Standard RS13

New York City Board of Standards and Appeals (BSA)

Air Movement and Control Association (AMCA)

American Society of Heating, Refrigeration and Air-Conditioning Engineers (ASHRAE)

American Society for Testing and Materials (ASTM)

American Welding Society (AWS)

National Fire Protection Association (NFPA)

Sheet Metal and Air-Conditioning Contractors' National Association (SMACNA)

Steel Structures Painting Council (SSPC)

Underwriters Laboratories Inc. (UL)

In addition, specific provisions cited herein shall govern for the associated specific application.

1.04 QUALITY ASSURANCE

A. Ductwork accessories, of types and sizes required, shall have been satisfactorily used for purposes similar to those intended herein for not less than three years.

B. Entities performing the Work of this Section shall have experience on at least two projects involving complexities similar to those required under this Contract.

1.05 DELIVERY, STORAGE, AND HANDLING

Protect ductwork and accessories against damage during shipping, receiving, storing, and handling. Place guards over damageable parts. Mark each package for identification.

1.06 SUBMITTALS

A. Submit the following in accordance with the requirements of "Shop Drawings, Catalog Cuts, and Samples" of Division 1 GENERAL PROVISIONS:

1. Ductwork layout, fabrication and installation drawings, including hangers and supports locations and details.

2. Acoustical lining data.

3. Dampers

4. Access doors

B. Submit three samples of the following:

1. Flexible duct

2. Flexible duct connectors

3. 12-inch x 12-inch flat piece of sheet metal, showing installation of acoustical lining and nosing

C. Submit duct leakage test data.

PART 2 - PRODUCTS

2.01 MATERIALS

Materials for ductwork and accessories shall be as specified below. All materials furnished shall comply with NFPA 90A.

Galvanized Steel Ductwork	ASTM A 527 with zinc coating conforming to ASTM A 525, coating designation G 90
Stainless Steel Ductwork (Shown on the Contract Dwgs.)	ASTM A 167, Type 304
Aluminum Ductwork (Shown on the Contract Dwgs.)	ASTM B 209, Alloy 3003, Temper
Boiler Breeching	Black steel ASTM A 366 or A 569
Kitchen Exhaust Ductwork	Black steel, ASTM A 366 or A 569 for concealed area Stainless steel, ASTM A 167, Type 304 for exposed area
Hangers and Supports (Including fasteners, anchors, rods, straps, trim and angles)	Matching materials of ductwork furnished
Flexible Duct	
Core	Spiral-wound spring steel with flameproof vinyl sheathing, complying with UL 181 or corrugated aluminum, complying with UL 181
Moisture Barrier	One-inch thick, continuous, flexible fiberglass sheath with vinyl vapor barrier jacket
Acoustical Duct Liner	
Liner	Insulation minimum density shall be 1.5 pounds per cubic foot. Insulation thickness, one inch.
Adhesives	ASTM C 916

Flexible Duct Connectors	Double layer of 30-ounce per square yard, finished weight, fire retardant, glass cloth; double-coated with neoprene
Gravity (Backdraft) Dampers	
Frame	0.125 - inch thick, ASTM B 221, Alloy 6063, Temper 5
Blade	0.070 - inch thick, ASTM B 221, Alloy 6063, Temper 5
Blade Edge Seals	Extruded vinyl
Pivot Pins	Nonferrous
Bearings	Oil impregnated bronze or nylon
Fire Dampers	
Frame	20-gauge galvanized steel
Closure Spring	Stainless steel
Blades	24-gauge galvanized steel
Perimeter Angle	14-gauge 1-1/2 inch x 1-1/2 inch galvanized steel
Ceiling (Fire) Dampers	
Frame	20-gauge galvanized steel
Blade	22-gauge galvanized steel
Access Doors	
Frame	24-gauge same material as ductwork
Gasket	Neoprene rubber
Double Wall Casing Core Insulation	Fiberglass or rock wool, 2.5 lb. per cubic foot minimum density

2.02 FABRICATION

A. Ductwork

1. Unless otherwise shown on the Contract Drawings or specified herein, gauges, reinforcement, and fabrication of all ductwork, including hangers and supports, shall be in accordance with SMACNA "HVAC Duct Construction Standards" and ASHRAE Handbook - Equipment, Fundamentals and Systems Volumes.

2. Ductwork sizes shall conform to the dimensions shown on the Contract Drawings.

3. All ductwork sizes shown on the Contract Drawings are clear inside dimensions. Where internal acoustical lining is required, duct sizes shall be correspondingly increased to accommodate the liner thickness so that net cross-sectional areas will not be reduced.

4. Furnish all ductwork, elbows, vanes, transition pieces, branch takeoffs, and manual volume dampers as shown on the Contract Drawings.

5. Limit angular tapers to 30 degrees for diverging concentric transition and 60 degrees for converging concentric transition unless otherwise shown on the Contract Drawings.

6. Radius elbows shall have a center line radius equal to 1 1/2 times ductwork width. Square elbows shall have double thickness turning vanes.

7. Do not use friction clamps for hangers and supports. Provide all supplementary steel required for installation of ductwork hangers and supports. All structural welding for hangers and supports shall be in accordance with AWS D 1.1.

8. Flexible duct shall be not more than 18 inches in length and shall have no intermediate seams. Provide moisture barrier where the flexible duct is located in unconditioned space other than within return air plenums.

9. Install acoustical duct liner for the distance shown on the Contract Drawings. Noise reduction coefficient for one-inch thick lining shall be not less than 0.70 based on ASTM C 423 test method. Installing two layers of liner to meet a minimum liner thickness will not be acceptable. Liner fastener shall be welded pin type.

10. Provide sleeves and flanges at ductwork penetrations of inside walls, except fire walls where fire dampers are installed. Extend ductwork insulation and vapor barrier through the ductwork sleeve. Sleeves shall be two inches larger than the ductwork plus its insulation.

11. Provide airtight penetrations where shown on the Contract Drawings.

12. Provide double wall casing, with two-inch thick insulated core, where shown on the Contract Drawings.

B. Kitchen Exhaust Ductwork

Provide kitchen exhaust ductwork in accordance with SMACNA "HVAC Duct Construction Standards", and NFPA 96. All welding of kitchen exhaust ductwork shall be in accordance with AWS D 9.1.

C. Boiler Breeching

1. Unless otherwise shown on the Contract Drawings, gauges, reinforcements, and fabrication of boiler breeching shall be in accordance with SMACNA "HVAC Duct Construction Standards".

2. All breeching shall have continuous weld joints and seams. All welding shall be in accordance with AWS D 9.1.

3. Maintain the required minimum distance from combustible materials as required by applicable codes.

4. Blind flanged cleanout shall be installed as shown on the Contract Drawings. Doors shall be double panel, insulated with two-inch calcium silicate and shall be gasketed.

5. Provide test holes and access doors in breeching as required for testing and cleaning. Test holes shall be sealed with plugs.

2.03 ACCESSORIES

A. Flexible Duct Connectors

1. Provide flexible duct connectors at inlet and discharge of all fans and locations shown on the Contract Drawings.

2. Flexible connectors shall be in accordance with NFPA 90A or 96, as applicable.

B. Backdraft Dampers

1. Backdraft dampers shall be parallel blades, counterbalanced, heavy duty type capable of withstanding maximum spot velocities of up to 3500 fpm.

2. Counterbalance setting shall be adjustable so that the damper can be operated in the range of 0.25 to 0.75-inch water gauge, unless otherwise shown on the Contract Drawings.

C. Fire Dampers

1. Provide fire dampers in accordance with UL 555.

2. Fire dampers shall bear a UL label and shall be approved by New York City Board of Standards and Appeals.

3. Fire resistance ratings of fire dampers shall comply with NFPA 90A and New York City Building Code Reference Standard RS 13.

4. Fire dampers shall be curtain type with damper curtain located inside or outside of air stream as shown on the Contract Drawings.

5. Fire dampers placed in vertical position shall be gravity-operated. Fire dampers placed in horizontal position shall be provided with all necessary springs and latches.

6. Provide fire dampers with fusible links rated at 165 degrees F, unless otherwise shown on the Contract Drawings.

7. Expansion clearance requirements between the sleeve and protected openings shall be as shown on approved manufacturer's drawings.

8. Provide access doors in the ductwork to permit inspecting, testing and resetting the damper.

9. Install fire dampers in duct extension sleeves with perimeter (mounting) angles and breakaway joints in accordance with NFPA 90A, SMACNA "Fire Damper Heat Stop Guide" and the requirements below.

10. Extension sleeves shall not extend more than six inches beyond the fire wall or partition, or floor on each side where it connects to ductwork.

11. Secure sleeves by perimeter angles on four sides of the sleeve on both sides of opening.

12. Breakaway joints shall be Engineer approved S-slip type.

D. Ceiling (Fire) Dampers

1. Construct and test ceiling dampers in accordance with UL 555.

2. Ceiling dampers shall bear a UL label and shall be approved by New York City Board of Standards and Appeals.

3. Fire resistance ratings of ceiling dampers shall comply with NFPA 90A and UL 555.

4. Provide ceiling dampers with fusible links rated at 165 degrees F, unless otherwise shown on the Contract Drawings.

5. Ceiling dampers shall be suitable for installation inside ductwork and surface mounting of diffusers or grilles. Hanger straps for mounting ceiling dampers shall be not less than 16-gauge, 1 1/2-inch channels.

6. Provide volume adjustment features in the fusible link to permit adjustment of damper blades to balance airflow through the damper.

E. Ductwork Access Doors

1. Install hinged access doors in ductwork where shown on the Contract Drawings.

2. Where hinged access doors cannot be provided with a clear 180-degree swing, removable access doors shall be used.

3. Provide gasketed, insulated double panel access doors in insulated ducts. For kitchen exhaust ductwork, the insulation shall be two-inch thick calcium silicate. Access doors in uninsulated ducts may be of single panel construction.

4. Install access doors in ductwork with separate frames.

2.04 SHOP PAINTING

A. Prepare exterior surfaces of black steel ductwork, except edges prepared for field welding, in accordance with SSPC-SP 6. Apply one shop coat of primer.

B. Do not paint finished surfaces, polished areas, galvanized steel, stainless steel, and aluminum materials.

2.05 SHOP TESTS

A. Shop test gravity dampers in accordance with AMCA Standard 500.

B. Perform manufacturer's standard shop tests on all ductwork accessories furnished.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install ductwork and accessories in accordance with SMACNA "HVAC Duct Construction Standards" and ductwork accessory manufacturers' installation procedures.

B. Coordinate all trades to ensure that no conflict exists in installation of ductwork and no ceilings, equipment or other materials are supported from ductwork or the ductwork hanger support system.

C. Coordinate as necessary to ensure that access doors or indicator buttons have been provided in hung ceilings for proper operation and maintenance of the installation.

3.02 FIELD TESTS

Upon completion of HVAC system installations, perform a leakage test of the ductwork in accordance with SMACNA "HVAC Air Duct Leakage Test Manual".

END OF SECTION

SECTION 15931

AIR OUTLETS AND INLETS

PART 1 - GENERAL

1.01 SUMMARY

This Section specifies requirements for air outlets and inlets.

1.02 REFERENCES

(Not Used)

1.03 PERFORMANCE REQUIREMENTS

A. Design and performance of components and methods specified herein shall comply with the applicable provisions of the codes, standards, recommendations of the entities listed below.

Air Diffusion Council (ADC)

Underwriters Laboratories Inc. (UL)

In addition, specific provisions cited herein shall govern for the associated specific application.

B. Unless otherwise shown on the Contract Drawings, sound levels and noise criteria for all air outlets and inlets shall not exceed the following levels measured at a location 42 inches below the center of the unit:

Noise Criterion Curve - N C	Sound Meter Readings - dBA
35	40

C. All air outlets and inlets shall distribute the design flow rate of air shown on the Contract Drawings evenly over the space intended, without causing noticeable drafts or dead spots anywhere in the ventilated area.

1.04 QUALITY ASSURANCE

Air outlets and inlets, of types and sizes required, shall have been satisfactorily used for purposes similar to those intended herein for not less than three years.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Deliver air outlets and inlets wrapped in factory-fabricated, fiber-board type containers. Identify, on outside of container, type of air outlets or inlets and location to be installed. Avoid crushing or bending and prevent dirt and dust from entering and settling in devices.

B. Store air outlets and inlets, in original cartons, in clean, dry spaces and protect them from weather.

1.06 SUBMITTALS

A. Submit the following in accordance with the requirements of "Shop Drawings, Catalog Cuts and Samples" of Division 1 - GENERAL PROVISIONS:

1. Each type, model number, size, service, blade setting angle, cfm, and pressure drop.

2. Sound power levels at design flow rates.

3. Throw and drop at design flow rates.

4. Material of unit, finish and mounting details (installation procedures).

5. Certified shop test reports.

B. Submit three samples of finishes of air outlets and inlets, for approval.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

Subject to compliance with requirements of this Section, provide air outlets and inlets of one of the following manufacturers:

Dynamics Corp. of America/Anemostat Products Div.

Wehr Corp./Carnes Co.

Krueger Manufacturing Co.

Philips Industries Inc./Titus Products Div.

2.02 MATERIALS

Materials for air inlets and outlets shall be aluminum or steel as shown on the Contract Drawings.

2.03 CONSTRUCTION FEATURES

A. General

Provide air outlets and inlets of type, capacity and size where shown on the Contract Drawings and as specified below.

B. Supply Diffusers

Unless otherwise shown on the Contract Drawings, provide all air diffusers with the following:

1. Multiblade volume damper, adjustable from face diffuser.

2. Air-equalizing deflectors, fully adjustable for horizontal to vertical air flow.

3. Removable core.

C. Linear Diffusers

1. Provide diffusers with fully adjustable air pattern controlling vanes, capable of deflecting the air pattern in a 180-degree radius. The air pattern shall be manually adjustable from the face of the diffuser.

2. The unit shall be capable of dampening the air flow rate without changing the air pattern or of changing the pattern without changing the air flow rate. Provide single leaf type damper with each slot opening throughout the entire diffuser length.

3. Screw holes or welded corners shall not be visible on diffusers or frames.

4. Where the diffusers require sectional installation, provide key strips in each extrusion to ensure positive alignment of all adjacent sections.

5. Provide inactive sections and mitered corners with black blankoff baffles.

D. Registers

1. Unless otherwise shown on the Contract Drawings, furnish all registers with the following:

a. Opposed blade volume damper with key operator, adjustable through the face of the register. Damper blades shall be linked to operate in unison and shall be capable of positive positioning from fully open to fully closed with the register installed in space.

b. Removable core.

2. Unless otherwise shown on the Contract Drawings, provide supply registers with the following:

   a. Double deflection grilles having horizontal face bars.

   b. Multiblade control grid at the duct branch or duct collar.

3. Provide return and exhaust registers with 40-degree horizontal fixed bars. Net effective free area of the register shall not be less than 75 percent of overall area.

E. Return Grilles

Provide return grilles with 40-degree horizontal fixed bars.

F. Transfer Grilles

Provide transfer grilles of the aluminum grid core type complete with mounting frame.

G. Dual Plenum Ceiling Diffusers for Linear Metal Type Ceiling

1. Interconnect plenums with a crossover duct sized to provide equal air distribution in both plenums.

2. Provide an oval inlet of 6-inch round equivalent size in the side of one plenum.

3. Space plenums to match the increment of the ceiling panels.

4. Provide plenum with an adjustable pattern diffuser outlet having 5/8-inch wide by approximately 46-inch long slot type opening with 1-inch wide face tie bars attached longitudinally to each side of slot opening and extending full length of the diffuser.

5. Provide diffusers to hang independently and securely so as not to transmit any vibration to the ceiling.

6. Provide adjustable pattern deflectors to have incremental air discharge pattern, from horizontal left or right to vertical.

H. Air Diffusers for Combination Light Fixtures

Air diffusers for combination light fixtures furnished and installed under the Section entitled "LIGHTING FIXTURES", shall meet the following requirements:

1. Supply air diffusers shall consist of single or dual supply plenums with crossover bridge and 3-inch high, oval, side or top air connection sized for connection to a 6-inch round flexible duct. Diffusers shall have adjustable pattern deflectors in each outlet slot and a volume damper in the inlet collar. Both adjustments shall be accessible through the diffuser outlet slot without disturbing the fixture lens or ceiling construction. Pattern deflectors shall lock positively in all set positions and shall permit a vertical discharge or a horizontal discharge pattern, the direction of which can be changed 180 degrees. Inlet static pressure and volume shall remain constant under all positions of pattern adjustment.

2. The side trim rails of the fixtures shall be continuously slotted for either supply or return air. The end trim rails shall be similarly slotted for return air through the fixture lamp cavity. Slot in the air diffuser plenum shall be compatible in size and location with the discharge slot in the side trim rails. A positioning socket or recess shall also be provided in the rail which shall receive the neck of the plenum and hold it securely in position over the slot without the use of screw-type fasteners.

3. When installed on the fixture, the highest point of the air diffuser assembly shall be not more than 7 1/2 inches above the finished ceiling and the clearance between the top of the fixture housing and the bottom of the crossover bridge shall not be less than 1/4 inch. Holding brackets designed to accept the mounting buttons on the diffuser plenum, shall be furnished on the fixture housing and shall hold the entire air diffuser assembly firmly in position on the fixture. A minimum of two such brackets shall be provided on each plenum.

4. The connection between the crossover bridge and the two diffuser plenums shall be airtight and the assembly of the air diffuser unit and the mounting of the unit on the light fixture shall be accomplished without the use of screw-type fastenings, tape, or other mechanical fasteners which are not an integral part of either the lighting fixture or the air diffuser. The entire assembly shall be compatible with the proposed ceiling construction and shall provide adequate clearance for duct connections to the diffuser air inlet.

5. Dual plenum supply air diffusers shall be capable of delivering up to 180 cfm of air in a horizontal pattern with an inlet static pressure not exceeding 0.21-inch water gauge. Single plenum supply diffusers shall be capable of delivering up to 90 cfm of air in a horizontal pattern with an inlet static pressure not exceeding 0.15-inch water gauge.

6. Coordinate the design and installation details of supply air diffuser units with the lighting fixture manufacturer furnishing said fixtures under this Contract and furnish to the manufacturer all drawings, details and information required for this purpose.

7. Complete air handling lighting fixture units shall meet UL requirements for use as a cooled or heated air outlet and a return air inlet.

2.04 SHOP PAINTING

Unless otherwise shown on the Contract Drawings, finishes for all air outlets and inlets, except for linear diffusers, shall be baked white enamel. Linear diffusers shall have white anodized finishes unless otherwise shown on the Contract Drawings. Finishes shall match the approved color samples submitted.

2.05 SHOP TESTS

Test and rate all air outlets and inlets in accordance with ADC 1062. Air outlets and inlets shall bear ADC seals.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install air outlets and inlets in accordance with manufacturer's installation procedures.

B. Coordinate all trades to ensure that the installation of air outlets and inlets is not in conflict with the work performed by other trades.

3.02 FIELD TESTS

Provide a qualified technical representative of the manufacturer to advise on the field tests specified in the Section entitled "TESTING, ADJUSTING, AND BALANCING OF AIR AND HYDRONIC SYSTEMS".

END OF SECTION

SECTION 15945

HVAC INSULATION

PART 1 - GENERAL

1.01 SUMMARY

This Section specifies insulation requirements for heating, ventilation, and air-conditioning (HVAC) sheet metal ductwork, piping and equipment.

1.02 REFERENCES

(NOT USED)

1.03 DESIGN AND PERFORMANCE REQUIREMENTS

A. Design and performance of components and methods specified herein shall comply with the applicable provisions of the codes, standards, recommendations of the entities listed below.

New York State Energy Conservation Construction Code

BOCA Basic Energy Conservation Code

American Society for Testing and Materials (ASTM)

National Fire Protection Association (NFPA)

Underwriters Laboratories Inc. (UL)

In addition, specific provisions cited herein shall govern for the associated specific application.

B. All insulation, including jackets or facings, adhesives, mastics, cements, tapes and glass cloth for fittings shall have composite fire and smoke hazard ratings as tested by ASTM E 84, NFPA 255, and UL 723 procedures, not exceeding a "Flame Spread" of 25 and "Smoke Developed" of 50.

C. Any treatment of jackets or facings to impart flame and smoke safety shall be permanent. The use of water soluble treatments is prohibited.

1.04 QUALITY ASSURANCE

A. Insulation materials and accessories, of types and sizes required, shall have been satisfactorily used for purposes similar to those intended herein for not less than three years.

B. Entities performing the Work of this Section shall have experience on at least two projects involving complexities similar to those required under this Contract.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Deliver insulation, coverings, cements, adhesives, and coatings to the construction site in containers with manufacturer's stamp or label affixed, showing fire hazard indexes of products.

B. All insulation components shall be stored at the construction site on pallets or raised platforms with suitable shed enclosures to protect against foreign matter and rain.

C. Before moving insulation materials from storage to the construction site, all insulation sections and component materials shall be inspected for damage. Remove damaged materials from the construction site and replace damaged materials, to the satisfaction of the Engineer, at no cost to the Authority.

1.06 SUBMITTALS

A. Submit the following in accordance with the requirements of "Shop Drawings, Catalog Cuts, and Samples" of Division 1 - GENERAL PROVISIONS:

1. Product data and installation procedures for each type of insulation.

2. Schedule showing product number, k-value, material thickness and furnished accessories for each HVAC system requiring insulation.

B. Submit sample of each insulation type required. Affix label on sample, completely describing product.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

Subject to compliance with requirements of this Section, provide insulation materials of one of the following manufacturers:

Manville Corp.

Certain - Teed Corp./Insulation Group

Owens - Corning Fiberglas Corp.

Knauf Fiber Glass

2.02 MATERIALS

A. Sheet Metal Ductwork Insulation

1. HVAC Supply, Return and Transfer Air Ductwork - concealed in hung ceilings, shafts and furred spaces

   a. Insulation shall be two-inch thick flexible blanket fiberglass with factory-applied foil-scrim-kraft (FSK) facing.

   b. Flexible blanket fiberglass insulation shall conform with ASTM C 553, Type I, Class B-3.

   c. The insulation shall be Manville R-Series "MICROLITE" with FSK facing, or approved equal.

2. HVAC Supply, Return, Transfer Air, Outside Air Supply Ductwork and Plenums-exposed in mechanical equipment rooms, crawl spaces, all unconditioned areas, and outdoors

   a. Insulation shall be 1 1/2-inch thick rigid fiberglass board with factory-applied all purpose (AP) white facing for indoors, and two-inch thick for outdoors.

   b. Rigid fiberglass board insulation shall conform with ASTM C 612, Class 1 except that the density shall not be less than 6 lbs. per cubic foot.

   c. The insulation shall be Manville "817 SPIN-GLAS" with AP white facing, or approved equal.

   d. Finish and weatherproofing are specified in 3.02 B.2.

3. Kitchen Exhaust Duct, Boiler Breeching, and Kitchen Exhaust Fan Insulation

   a. Insulation shall be two-inch thick calcium silicate block.

   b. Calcium silicate block insulation shall conform with ASTM C 533, Type I, and shall be Manville "THERMO-12", or approved equal.

   c. Finish is specified in 3.02 B.3.

4. Insulation for Built-Up Central Station HV and HVAC Units

   a. Casing insulation shall be two-inch thick fiberglass duct liner with a neoprene coating.

b. Insulation shall have a density of 3 lbs. per cubic foot with a thermal conductivity k = 0.24 at 75 degrees F mean temperature and suitable for air velocities up to 5000 fpm.

c. Insulation shall be Manville "LINACOUSTIC", or approved equal.

B. HVAC Piping Insulation

1. Insulation Thickness

INSULATION MINIMUM THICKNESS (INCHES) - PIPE, FITTINGS AND VALVES

Piping System	Fluid Temp Range, Deg. F	Pipe Sizes (NPS) Run-Out* Up to 2"	Up to 2"	2 1/2" to 4"	Larger than 4"
Heating Systems (**)					
High Temp Hot Water High Press Steam	306-450	1.5	2.5	3.0	3.5
Medium Press Steam	251-305	1.5	2.5	2.5	3.0
Low Press Steam Heating Hot Water	201-250	1.0	1.5	2.0	2.0
Steam Condensate includ. Drip Assembly (For Feed Water)	Any	1.0	1.5	2.0	2.0
Cooling Systems					
Chilled Water Make-up, City & Cold Water	40-60	0.5	0.75	1.0	1.0
Refrigerant	Below 40	1.0	1.5	1.5	1.5

*Maximum Length 12 ft; above 12 ft. length, insulation thickness shall comply with adjacent columns.

**Heating Systems in outdoor locations shall have an additional thickness of 1/2-inch insulation above the thickness specified in this TABLE for indoor locations.

2. All Heating and Cooling Systems - Indoor Locations

a. Insulation shall be molded fiberglass insulation with factory-applied all purpose (AP) facing or aluminum jacket as specified in c. and d., below.

b. Molded fiberglass insulation shall conform with ASTM C 547, Class 1.

c. Insulation, except for High Temperature Hot Water piping, shall be Manville "MICRO-LOK" with AP facing, or approved equal.

d. For High Temperature Hot Water piping, provide 0.016-inch thick aluminum jacket for pipes 2 1/2 inches andlarger, and 0.010-inch thick aluminum jacket for pipes 2 inches and smaller, with a built-in isolation felt.

e. Fitting, valve, and flange insulation requirements are specified in 3.02 C.1.

3. Heating Systems - Outdoor Locations

a. Insulation shall be calcium silicate with aluminum jacket.

b. Calcium silicate insulation shall conform with ASTM C 533, Type I, and shall be Manville "THERMO-12", or approved equal.

c. Insulation jacket shall be 0.016-inch thick aluminum for pipes 2 1/2 inches and larger, and 0.010-inch thick for pipes 2 inches and smaller with a built-in isolation felt. All seams and joints shall be weatherproof.

4. Cooling Systems - Outdoor Locations

a. Insulation shall be molded fiberglass with aluminum jacket.

b. Molded fiberglass insulation shall conform with ASTM C 547, Class 1, and shall be Manville "MICRO-LOK", or approved equal.

c. Insulation jacket shall be 0.016-inch thick aluminum for pipes 2 1/2 inches and larger, and 0.010-inch thick for pipes 2 inches and smaller with a built-in isolation felt. All seams and joints shall be weatherproof.

5. Emergency Generator Exhaust Piping, Tail Pipe Exhaust Ductwork, and Fan Insulation

a. Insulation shall be four-inch minimum thickness and shall achieve a resulting operating exterior surface temperature not to exceed 150 degrees F.

b. Insulation shall be calcium silicate with aluminum jacket for piping and ductwork or with finish specified in 3.02 C.2 for fittings, silencers, and exhaust fans.

c. Calcium silicate insulation shall conform with ASTM C 533, Type I, and shall be Manville "THERMO-12", or approved equal.

d. Insulation jacket shall be 0.016-inch aluminum, factory-applied, with a built-in isolation felt. All seams and joints shall be sealed.

C. Equipment Insulation

1. Insulation Thickness

EQUIPMENT	FLUID TEMP, Deg. F	INSULATION THICKNESS (INCHES)	INSULATION MATERIAL TYPE
Steam Flash Tank and Condensate	Up to 275	2	A
Compression or Expansion Tanks for Heating	Up to 250	2	A
Hot Water Exchanger - Water to Water	Up to 375	3	A
Heat Exchanger - Steam to Water	Up to 375	3	A
Hot Water Generator	Up to 375	3	A
Expansion Tank - Chilled Water	Up to 55	2	A
Refrigerant Equipment	Up to 40	1.5	A
Hot Water Pumps	Up to 250	3	B
Chilled Water Pumps	Up to 55	3	B

2. Insulation Material

a. Type A: Calcium silicate, curved or scored block insulation

Calcium silicate block shall conform with ASTM C 533, Type I, and shall be Manville "THERMO-12", or approved equal.

b. Type B: Rigid fiberglass board insulation

Rigid fiberglass board insulation shall conform with ASTM C 612, Class 1 except that the density shall not be less than 4.25 lbs. per cubic foot. The insulation shall be Manville "815 SPIN-GLAS", or approved equal.

PART 3 - EXECUTION

3.01 PREPARATION

A. Insulation shall be applied only after the piping systems have been hydrostatically tested and approved by the Engineer.

B. Install insulation subsequent to installation of heat tracing and any coating or painting.

C. Surfaces shall be clean of dust, grease and foreign matter and dry before application of insulation.

3.02 INSTALLATION

A. General

1. Install insulation products in accordance with this Section and manufacturer's installation procedures.

2. Install insulation materials with smooth and even surfaces. Install each continuous insulation course with full-length units of insulation, with single cut piece to complete run. Do not use multiple cut pieces or scraps abutting each other.

3. Maintain integrity of vapor-barrier jackets on insulation, and protect to prevent puncture or other damage.

4. Extend insulation without interruption through walls, floors, roofs, ceilings and similar penetrations.

5. Where ducts and pipes pass through walls, floors or partitions, the space around the insulated duct or pipe shall be sealed with Thermafiber semi-rigid blanket manufactured by U.S. Gypsum, or approved equal.

6. For double layer insulation, apply each layer of insulation using staggered joint method. Apply each layer of insulation separately.

7. Fill in scored block, seams, chipped edges and depressions, and cover over wire netting and joints with insulation cement of sufficient thickness to remove surface irregularities and properly embed netting.

8. The finish, including any vapor barrier treatment, shall lap adjacent sections at both the transverse and longitudinal joints.

9. When supplementary load-bearing material is required at hangers and supports to resist compression of the insulation, the load-bearing thermal insulation shall be the same thickness as the normal pipe thermal insulation. The material shall conform to the "Flame Spread" and "Smoke Developed" ratings as specified in 1.03 B.

10. Do not insulate boiler manholes or equipment end head pivots, handholes, cleanouts, ASME stamp, and manufacturer's nameplate. Provide neatly beveled edge at interruptions of insulation.

11. Provide removable insulation sections to cover parts of equipment which must be opened periodically for maintenance. These shall include metal vessel covers, fasteners, flanges, frames and accessories.

12. All ductwork angle joints and reinforcement shall be insulated.

13. Where internal ductwork insulation is required, the exterior duct insulation may be omitted, provided that the equivalent "R" factor for the internal duct insulation is the same as the external duct insulation requirements.

14. Valves, fittings, strainers, and other piping appurtenances shall be insulated to match those of the systems to which they are connected.

15. All insulation and exterior jackets that are damaged shall be replaced with new material as specified, to the satisfaction of the Engineer.

B. Sheet Metal Ductwork Insulation

1. Flexible (Blanket) Fiberglass Insulation

   a. Wrap insulation tightly on ductwork with all transverse joints butted and longitudinal joints overlapped a minimum of 2 inches.

b. Seal all joints with 3-inch wide vapor-barrier strips using an approved adhesive. All cuts and tears shall be sealed with strips of vapor-barrier jacket applied with adhesive.

c. Secure insulation in place with 18-gauge copper clad wire loops, 12 inches on centers. All joints shall be lapped and sealed in place with Foster (H.B. Fuller Co./Foster Products Div.) "85-20" adhesive, or approved equal. Adhesive shall be applied so that insulation conforms to duct surfaces uniformly and firmly.

d. In addition to the requirements of a, b, and c above, secure all ductwork larger than 36 inches in width or depth with welded or adhesive type clips on top and bottom or sides of duct, spaced 18 inches on centers along the center line of duct. Cut off exposed portion of fastening pin as close to the clip as possible and seal with 3-inch wide vapor barrier with Foster "85-20" adhesive, or approved equal.

2. Rigid Fiberglass Board Insulation

a. All insulation shall be applied with edges tightly butted.

b. Impale insulation over stick clips or pins welded to duct with protruding ends of pins cut off flush, after the stick clips have been applied.

c. Spacing of pins, to hold insulation firmly in place, shall be a minimum of one pin per square foot.

d. Seal all joints and penetrations with a three-inch wide strip of the same material, applied with approved adhesive to both surfaces.

e. Where welded pins cannot be installed, the insulation shall be secured to the duct with approved adhesive and 18-gauge copper clad wire loops.

f. Finish

Apply a tack coat of approved adhesive on all corners. Embed reinforcing mesh into wet adhesive and smooth out to eliminate wrinkles. Overlap all reinforcing mesh seams a minimum of two inches. Apply finish coat of approved mastic to entire reinforcing mesh fabric.

g. Weatherproofing of Outdoor Ductwork

(1) Apply a coat of Manville "INSULKOTE PRIMER E" to duct surface.

(2) Install a one-inch galvanized steel wire mesh tightly stretched and secured over the duct insulation. All steel mesh edges shall be bound together with wire.

(3) Apply two successive 1/8-inch thick coats of Manville "INSULKOTE ET." Embed coating completely and cover all of the wire mesh.

3. Calcium Silicate Block Insulation

a. Insulation shall be securely banded in place with tightly butted joints, staggered and secured with 12-gauge annealed stainless steel wire, 12 inches on centers. Where required, provide welded studs, clips or angles as anchors for wires.

b. Finish

(1) Over the insulation install a one-inch hexagonal copper clad steel wire mesh tightly stretched in place and secured by wiring to anchors. All steel mesh edges shall be bound together with wire.

(2) Apply two coats of 1/4-inch thick hydraulic insulating finish cement trovelled to a smooth finish.

4. Duct Liner for Built-Up Central Station HV And HVAC Units

a. Insulation shall be installed on the inside surfaces of the unit. All metal to metal contacts and joints shall be sealed with a continuous bead of an approved sealant.

b. Apply insulation to interior of casing with 100 percent coverage of an approved adhesive.

c. The black surface of the liner shall face the air stream. All joints shall be snug and neatly butted. Insulation shall be fastened to casing interior with mechanical fasteners spaced 12 inches on centers. All mechanical fasteners shall be flush with the perforated liner surface, and coated.

d. All exposed edges and joints shall be sealed with approved adhesive and reinforced with fiberglass mesh. A sheet metal nosing shall be installed on all leading edges of the liner.

e. Install a galvanized steel perforated panel over the entire interior surface secured with the insulation mechanical fasteners.

C. Piping Insulation

1. Molded Fiberglass Insulation

a. Longitudinal lap joints and butt joints shall be sealed with approved adhesive. Butt joints shall be wrapped with a minimum three-inch wide strip of same material as pipe jacket.

b. Fittings, valves, flanges and accessories shall be insulated with compressed fiberglass of two lbs. per cubic foot density and the same thickness of pipe insulation, wired in place with 18-gauge galvanized steel wire. Apply a uniform coat of fire retardant vapor barrier coating to the entire surface. Then embed into wet coat a layer of fiberglass tape extending 2 inches onto adjacent pipe covering. Apply a finish coat of fire retardant vapor barrier over entire surface.

c. For high temperature hot water systems in indoor locations, apply outer metal jacket over the insulation. All seams and joints shall be waterproof. Fittings, valves and flanges shall be covered with either a fabricated metal jacket or matching aluminum fitted cover, with sealed joints.

d. For cooling systems in outdoor locations, apply outer metal jacket over insulation. All seams and joints shall be weatherproof. Fittings, valves, flanges and accessories shall be covered with either a fabricated metal jacket or matching aluminum fitted cover, with sealed weatherproof joints.

2. Calcium Silicate Insulation

a. Circumferential and longitudinal joints shall be tightly butted and the half sections wired in place with 16-gauge stainless steel wire, 12 inches on centers. Where multi-layer application is required, all joints shall be staggered and the outer layers wired on as specified above.

b. Fittings, valves, flanges, and accessories including emergency generator exhaust components, shall be insulated with mitered sections of same material and thickness as pipe insulation, wired in place with 18-gauge galvanized wire. Apply an exterior coat of insulating cement with an embedded layer of fiberglass tape.

c. Apply outer metal jacket over the insulation. All seams and joints of jacket shall be weatherproofed for outdoor location and sealed for indoor location.

D. Equipment Insulation

1. Type A

a. Cut, score or miter calcium silicate insulation to fit contour of equipment and secure with 1/2-inch by 0.015-inch galvanized steel bands or 16-gauge galvanized wire, 12 inches on centers.

b. Weld pins or stick clips spaced 18 inches on centers may be used on flat surfaces.

c. Provide stationary anchors for all wires and bands.

d. Stagger all joints and fill all small voids with insulating cement.

e. Over the insulation, one-inch galvanized wire mesh shall be tightly stretched in place over the entire surface and finished with 1/4-inch thick coat of insulating cement trowelled to a hard and smooth finish.

2. Type B

Insulate pumps with removable aluminum boxes, insulated with 3-inch insulation, mechanically fastened to the metal enclosure. All joints and exposed edges shall be sealed and reinforced with a glass cloth and approved adhesive. An aluminum nosing shall be installed on all exposed edges of the enclosure to protect the insulation.

Removable aluminum boxes shall be of required size to clear all components of the pumps. All holes and slots shall have hemmed edges.

END OF SECTION

SECTION 15992

TESTING, ADJUSTING, AND BALANCING OF AIR AND HYDRONIC SYSTEMS

PART 1 - GENERAL

1.01 SUMMARY

A. This Section specifies requirements for testing, adjusting and balancing of all air and hydronic fluid distribution systems, including the equipment and devices associated with each system.

B. The Work includes setting speed and flow, adjusting equipment and devices installed for systems, recording data, conducting tests, preparing and submitting reports, and recommending modifications to the mechanical installations specified in other Sections of the Specifications.

C. The following related work is specified in other Sections of the Specifications, and is not part of the Work of this Section:

1. Installation and start-up of equipment and devices to be tested, adjusted, and balanced.

2. Pressure testing of piping and ductwork systems.

3. Electrical hook-up and wiring of equipment and devices to be tested, adjusted, and balanced.

1.02 REFERENCES

(NOT USED)

1.03 PERFORMANCE REQUIREMENTS

A. Procedures, measurements, instruments and test reports for testing, adjusting and balancing work shall comply with the applicable provisions of the codes, standards, recommendations of the entities listed below.

American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE)

Sheet Metal and Air Conditioning Contractors National Association (SMACNA)

National Environmental Balancing Bureau (NEBB)

Associated Air Balance Council (AABC)

In addition, specific provisions cited herein shall govern for the associated specific application.

B. The air delivery or intake of each diffuser, grille and register shall be as designed or within five percent of the air flow rates shown on the Contract Drawings.

C. The fan air flow rate and static pressure rise across the fan shall be within 10 percent above the design value at design speed.

1.04 JOB CONDITIONS

A. The Contractor shall have the testing and balancing specialist review his work with the respective manufacturers of the equipment and devices involved, and shall coordinate and schedule all Work.

B. The Contractor shall furnish and install balancing dampers,pressure taps, gauges, valves, and other components as required for a properly balanced system, whether or not specified herein or shown on the Contract Drawings, all at no additional cost to the Authority. Adjustment or replacement of parts recommended by the testing and balancing specialist shall be made in strict accordance with the respective equipment manufacturer's recommendations.

C. The Contractor shall have the control manufacturer's representative set the adjustment of the automatically operated dampers and control valves to operate as required.

1.05 QUALITY ASSURANCE

Entities performing the Work of this Section shall be certified by NEBB or AABC and shall have experience on at least two projects involving complexities similar to those required under this Contract.

1.06 SUBMITTALS

A. Submit blank forms of test reports indicating all data to be included.

B. Submit certified test reports, signed by the authorized representative of the testing and balancing specialist. Include identification and types of instruments used, and their most recent calibration date with submission of final test report.

C. Recommendations which the testing and balancing specialist deems necessary for the proper operation of the system shall be submitted in writing by the Contractor to the Engineer.

PART 2 - PRODUCTS

2.01 PATCHING MATERIALS

Unless otherwise shown on the Contract Drawings, use same products as originally installed for patching holes in insulation, ductwork and housings which have been cut or drilled for test purposes, including access for test instruments, attaching jigs, and similar purposes.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine installed work and conditions under which testing is to be done to ensure that work has been completed, cleaned, and is operable. Do not proceed with testing, adjusting and balancing until unsatisfactory conditions have been corrected in a manner approved by the testing and balancing specialist.

B. Examine the air systems to see that they are free from obstructions. Determine that all dampers and registers are open, that moving equipment is lubricated, that filters are installed, automatic controls are functioning, and perform other inspection and maintenance activities necessary for proper operation of the systems.

C. Examine the hydronic systems to see that they are free from abnormal obstructions, and that all piping, valves and equipment have been properly made fully operational. Determine that all equipment and control systems are performing correctly by functional testing.

3.02 TESTING, BALANCING, AND ADJUSTING

A. Testing and balancing specialist shall perform tests and compile test data for all air systems and hydronic systems.

B. Data shall include a schematic diagram locating the air inlets, outlets, fans, equipment, dampers and regulating devices for air systems, and a schematic diagram for location of balancing valves, flow indicators, equipment, and devices for hydronic systems.

C. All instruments used shall be accurately calibrated and maintained in good working order.

D. Air Systems

The testing, adjusting and balancing of air systems shall include but not be limited to the following:

1. Test, record and adjust fan rpm to design requirements.

2. Test and record motor full load amperes.

3. Make pitot tube traverse of main supply ducts and obtain design flow rate at fans.

4. Test and record system static pressure, velocity pressure and total pressure.

5. Test and adjust system for design supply, transfer and return air flow rate.

6. Test and adjust system for minimum and maximum design flow rates of outside air.

7. Test and record return air temperatures.

8. Test and record entering mix air temperatures.

9. Test and record leaving air temperatures.

10. Adjust all main supply, return, relief, and exhaust air ducts to proper design flow rate.

11. Adjust all zones to proper design flow rate for supply, return, transfer, relief and exhaust air.

12. Test and adjust each diffuser, grille and register.

13. Each grille, diffuser and register shall be identified as to location and area on the schematic diagram.

14. Size, type and manufacturer of diffusers, grilles and registers and all tested equipment shall be identified and listed in the final report. Manufacturer's data on all equipment shall be used to make required calculations for testing, adjusting and balancing. Readings and tests of diffusers, grilles and registers shall include design required velocity and test resultant velocity, required flow rate and test resultant flow rate after adjustments.

15. All diffusers, grilles and registers shall be adjusted to minimize drafts in all areas.

16. Dampers shall be permanently marked after air balance is complete so that they can be restored to their correct position, if disturbed later.

17. Openings in ductwork for pitot tube insertion shall be sealed with snap-in plugs after air balance is complete.

E. Hydronic Systems

1. Preliminary procedure prior to balancing shall include but not be limited to the following:

   a. Examine water in systems and determine if water has been treated and cleaned.

   b. Check expansion tank to determine that it is not air bound and the system is completely full of water.

   c. Purge all air vents at high points of water systems,check automatic air vents and determine if they are operating properly.

   d. Coordinate with control manufacturer for required cooling and heating temperature controls and corresponding automatic valve operation settings.

   e. Open all normally open valves to full open position. Set automatic valves to full coil flow.

   f. Complete air balance shall have been accomplished before final water balance begins.

   g. Check water pumps for pump rotation and for proper flow rate delivery against manufacturer's pump curves.

   h. Set all balancing valves for required flow delivery at mains and branch mains to cooling and heating elements.

   i. Upon completion of flow readings and adjustments of balancing valves, mark all settings and record data, so that they can be restored to their correct "balanced" position, if disturbed later.

2. After preliminary procedure has been completed, perform the balancing of hydronic systems as follows:

   a. After required cooling and heating temperature controls and automatic valve operation settings are made, recheck pump flow requirements and readjust system as required.

   b. Record pressure drop through coil at set flow rate of coil for full cooling and on full heating. Set pressure drop across bypass valve to match coil pressure drop.

   c. Record and check the following items at each cooling and heating element:

(1) Inlet water temperatures and static pressure at connections.

(2) Leaving water temperatures and the pressure drop of each coil.

(3) Flow rate through coil with control valve stroked manually wide open.

d. Record operating suction and discharge pressures of *each pump and final total dynamic head and rated* amperage versus actual amperage of pump motors.

e. Record entering and leaving water temperatures and flow through all equipment and devices.

f. Check and record all flow rates at all locations in the piping system with flow meters.

F. Final testing, adjusting and balancing shall be performed during summer season for air conditioning systems and during winter season for heating systems, including operation when outside conditions are within 5 degrees F wet bulb temperature of maximum summer design condition, and within 10 degrees F dry bulb temperature of minimum winter design condition.

G. Retest, adjust, and balance systems subsequent to system modifications. Resubmit test results.

END OF SECTION

A

SECTION 16000

ELECTRICAL GENERAL REQUIREMENTS

PART 1 - GENERAL

1.01 SUMMARY

Unless otherwise shown on the Contract Drawings, or unless otherwise specified in other Sections of these Specifications, the general requirements specified in this Section are applicable to all electrical work of this Contract. Additional requirements applicable to individual Sections of these Specifications are specified in those Sections, or are shown on the Contract Drawings.

1.02 REFERENCES

The following is a listing of publications referenced in this Section:

American National Standards Institute

ANSI C 2	National Electrical Safety Code

American Society of Testing and Materials (ASTM)

ASTM D 178	Standard Specification for Rubber Insulation Matting

National Fire Protection Association (NFPA)

NFPA 70	National Electrical Code

Occupational Safety and Health Administration (OSHA)

1.03 QUALITY ASSURANCE

A. Any entity performing Work shall have had experience on at least two projects involving quantities and complexities at least equal to those required under this Division or the applicable Section thereof.

B. All workmen performing under this Division shall be skilled workers of the trade involved. Where specialty work, such as splicing or welding are required, submit proof of training, experience and work history for each workman, for review by the Engineer. Only approved workmen shall perform specialty work.

C. All electrical work shall be performed under the supervision of an electrical contractor, licensed in the state (and the city as required) in which the work is to be performed. Submit a copy of the qualifying license for review by the Engineer.

D. All calculations required by this and other various Sections of these Specifications, or as shown on the Contract Drawings, shall be certified and sealed by a Professional Engineer licensed in the state in which the work is to be performed, and shall be submitted to the Engineer for review.

E. Various Sections of these Specifications contain the requirement for the specific material or equipment to be furnished with an experience statement "satisfactorily used for purposes similar to those intended herein" or words of similar intent and a statement that specifies the required experience time. These statements shall mean that the manufacturer of the material or equipment being furnished for the work specified in this Contract shall have manufactured similar material or equipment to that specified, for at least the time specified.

F. In various Sections of this Division there is a statement which refers to the length of required experience which must be satisfied.

G. Polyvinyl Chloride

Polyvinyl chloride (PVC) or items containing PVC shall not be installed in any indoor area subject to human occupancy.

H. Asbestos

Asbestos or items containing asbestos shall not be furnished or installed.

I. Conformance Labels

All electrical materials and equipment for which there is a nationally recognized standard shall bear the conformance labeling of the third party inspection authority, such as Underwriters Laboratories Inc., Factory Mutual, ETL, or approved equal. Where the phrase "where there are established UL standards, shall bear the UL label", or words of similar intent appear in other Sections, the instructions for the conformance label above shall apply.

1.04 CODES AND STANDARDS

A. The electrical installation shall conform to all requirements of *ANSI C2, NFPA 70,* and the codes and standards specified in other Sections, all local codes and the requirements of OSHA, which would be applicable if the Authority were a private corporation.

B. Standards publications of technical organizations and regulatory agencies are referenced in other Sections, and unless stricter requirements are indicated, materials and equipment so specified shall be manufactured, tested and installed to conform, as a *minimum,* to the requirements of such reference standards and publications.

C. Installations for aeronautical markers, lighting, guidance signs, and other work as shown on the Contract Drawings, shall comply with the standards of the Federal Aviation Administration (FAA), where applicable.

D. In case of conflict between provisions of codes, laws, and ordinances, the *more stringent requirement shall apply.*

1.05 DELIVERY, STORAGE, AND HANDLING

A. Deliver material in manufacturers' original unopened protective packaging.

B. Store materials in original packaging in a manner to prevent soiling, physical damage, wetting or corrosion prior to installation.

C. Handle in a manner to prevent damage to finished surfaces.

D. Where possible maintain protective coverings until installation is complete and remove such covers as part of final clean-up.

E. Touch up any damage to finishes to match adjacent surfaces to the satisfaction of the Engineer.

1.06 SUBMITTALS

A. Submit not less than the following in accordance with the requirements of "Shop Drawings, Catalog Cuts, and Samples" of DIVISION 1 - GENERAL PROVISIONS:

1. Catalog cuts to be reviewed and approved by the Engineer.

a. Conduit, and fittings
b. Wire and cable
c. Wiring devices
d. Multi-outlet assemblies
e. "Standard" outlet and junction boxes

f. Medium voltage cable, splicing and termination kits
g. Lightning arresters
h. Capacitors
i. Panelboards and cabinets
j. General purpose tranformers
k. Circuit breakers
l. Lighting fixtures
m. Pulling devices and end seals
n. Special pull and junction boxes
o. Supporting devices

2. Shop Drawings

a. Substation and high-voltage transformers
b. Switchgear
c. Switchboards
d. Motor control centers
e. Emergency lighting battery systems

B. Training, experience and work history for certified splicers and welders.

C. Calculations where required by the Specifications or the Contract Drawings.

D. Working drawings for the installation sequence of medium voltage cables, and other systems where shown on the Contract Drawings, including the reel designations for each leg of the installation. Drawings shall include the calculations for pulling tensions and sidewall pressure of all cable pulls, including identification of manhole locations with splices and manholes which will be "pulled-through" without splicing. Calculations must be certified and sealed by a Professional Engineer licensed in the State in which the work is to be performed.

E. A final copy of the records and certified test reports for all tests, to the Engineer for review, for not less than the following:

1. Primary cable and terminators insulation testing.

2. Insulation testing of 600V (nominal) cables rated 100 amperes (#3 AWG) and above.

3. Ground resistance test of each service ground.

4. Ground fault circuit breaker and receptacle testing.

5. Setting of all adjustable overcurrent devices.

6. Setting or size of all overload elements installed, indicating the following:

   (a) Motor designation

   (b) Nameplate horsepower, full load current, voltage and phases.

   (c) Operating current and voltage.

   (d) Overload element size or setting.

7. Emergency power distribution equipment and system test results.

F. One set of prints of Contract Drawings neatly marked up to show any deviations in the actual installation from the conditions shown on the Contract Drawings as issued, and showing the exact location of all equipment and conduit runs, as actually installed.

G. Nameplate designations

1.07 SPECIAL TERMS

Throughout this and other Sections of this Division the term "Authority" is used. In PATH contracts, substitute the term "PATH" is deemed substituted for the term "Authority".

PART 2 - PRODUCTS

2.01 AUTHORITY FURNISHED EQUIPMENT AND MATERIAL (AFEM)

Equipment and material furnished by the Authority is specified in DIVISION 1.

2.02 MATERIAL AND EQUIPMENT TO BE FURNISHED

Equipment and materials furnished shall be new and unused, prior to this installation, first grade commercial quality and shall be essentially the standard cataloged products of a manufacturer regularly engaged in the manufacture of the products. Only those items specifically shown on the Contract Drawings as existing, relocated or Authority furnished shall be reused in this installation. Rebuilt or remanufactured equipment will not be permitted.

2.03 IDENTIFICATION

A. All parts of equipment, such as switchboards, panelboards, safety switches, motor starters, circuit breakers, time clocks, contactors and similar items shall be identified by name, function or control with laminated plastic nameplates consisting of two black sheets with one white sheet bonded to and between the two outer sheets and having letters machine engraved in the face sheet to the depth of the white plastic. Nameplates shall not be smaller than 1 inch x 3 inches with characters not less than one quarter inch. Where letter sizes are not specified, use one inch high letters for panelboards, switchboards and motor control centers and one quarter inch high elsewhere. Nomenclature shall be according to a schedule approved by the Engineer.

B. All device plates other than lighting switch plates, telephone and 120 volt, single phase, 15 or 20 ampere receptacles, shall have black or white (as directed) silkscreened lettering Helvetica Medium type face (or other type face as directed by the Engineer) designating:

1. System

2. Voltage (where applicable)

3. Number of phases (where applicable)

4. Current rating (where applicable)

5. Frequency (where applicable)

C. Before placing orders for nameplates or silk-screened device plates, submit a typewritten list to the Engineer for review.

D. The outside of the covers of all junction or pull boxes located above hung ceilings and the inside of the covers of all junction or pull boxes exposed shall be labeled with an indelible marker indicating the operating voltage and the system contained therein.

E. All device plates of receptacles connected to a standby or emergency power distribution system shall be labeled with an orange plastic nameplate, engraved with the panelboard and circuit number to which the receptacle is connected. Nameplate character engraved shall be not less than one quarter inch in height.

F. Unless otherwise shown on the Contract Drawings, all panelboards, switchboards, switchgear, circuit breakers, switches and transformers connected to a standby or emergency power distribution system shall be finished Federal Safety Orange in color.

2.04 RUBBER MATTING

A. Provide continuous insulated rubber matting not less than 36 inches wide and not less than one quarter inch thick in one piece in front of:

1. Substation Transformers

2. Switchgear

3. Switchboards

4. Motor control centers

5. Panelboards

6. On each side and end of a standby or emergency generator set

7. Other locations as shown on the Contract Drawings

B. Matting shall conform to ASTM D 178, Type 2.

PART 3 - EXECUTION

3.01 GENERAL

A. Work of this Division shall include all labor, material and apparatus necessary for the completion of all electrical work as shown on the Contract Drawings and as hereinafter specified, left ready for satisfactory operation.

B. Coordinate with Authority operations and construction by other trades.

1. Coordinate with the Work of all trades as necessary to facilitate timely completion, avoid unnecessary cutting and patching and to insure proper installation and operation of all equipment.

2. Coordinate all components and aspects of the work, in order to minimize power shutdowns to the power distribution systems. Should any part of the Work require an "off-hours" shutdown in excess of 8 hours, supply temporary services or feeders as required to maintain operation of the existing systems and equipment.

3. Furnish to appropriate trades, shop drawings, catalog cuts and instructions necessary for construction of concrete bases, concrete encasement, anchor bolts, and other construction required to accommodate installations under other Sections.

4. Obtain all wiring diagrams and other instructions required for proper electrical connection of equipment installed or furnished under other Divisions of these Specifications and coordinate the installation, wiring and connections for equipment furnished under this Division, or other various Divisions.

C. The arrangement of electrical equipment and conduit runs as shown on the Contract Drawings and described in the Specifications is schematic. Locate and install electrical work in coordination with other trades so that all electrical equipment and material is installed with working clearances in accordance with NFPA 70. Route conduit to avoid interference with existing installation and with work to be performed by other trades.

D. The location of equipment and motors shown on the Contract Drawings shall be subject to minor revisions due to field conditions or coordination with other trades without any increase in Contractor's compensation. Prior to roughing-in, verify the exact location of all electrical connections to equipment and motors from reviewed shop drawings and field verification.

E. Maintain records of all inspections, testing, overload and overcurrent settings throughout the construction and any corrective actions taken, and submit records to the Engineer for review.

F. All electrical work shall be subject to inspection by the Engineer. Correct any deficient work, as required for the approval of the Engineer.

G. Any equipment, materials, wiring or labor that are a necessary part of the electrical work and to its proper performance, although not specifically mentioned herein or shown on the Contract Drawings, shall be furnished and installed as if called for in detail, without additional cost to the Authority.

3.02 REMOVALS, RELOCATIONS, RECONNECTIONS, RESTORATIONS

A. Relocate existing equipment and materials as shown on the Contract Drawings.

B. Unless otherwise shown on the Contract Drawings, existing equipment and materials that are to be removed and not required to be relocated under this Contract, will become the property of the Contractor and shall be removed from the property of the Authority, and shall be properly disposed of. Disposal of equipment and materials shall comply with all local, state and Federal laws and regulations as if the Authority was a private corporation.

C. Unless specifically shown on the Contract Drawings, salvaged equipment and materials shall not be reused in the installation.

D. If existing electrical feeders, wiring, conduit, lighting fixtures or equipment interfere with the installation of new construction of any trade, the existing electrical feeder, wiring and conduit shall be rerouted or the equipment relocated in a manner approved by the Engineer to permit installation of the new construction. Where existing circuits or devices, or portions of the existing wiring system are to remain in service, but are interrupted by the construction, continue the existing wiring to maintain the remainder of the wiring system in operation.

E. Notify the Engineer immediately of any damage caused by the Contractor to existing wiring, services or feeders which are to remain in service. Repair the damage in a workmanlike manner to restore to service, at no cost to the Authority.

F. Before shutdown or discontinuation of service on any circuit, system or feeder, coordinate such activities with the Engineer in order to minimize shutdown periods. Provide a minimum of two weeks notice in writing to the Engineer before performing any shutdowns. The minimum period may be reduced with the express written permission of the Engineer.

3.03 LOCATION OF EQUIPMENT

A. Unless otherwise shown on the Contract Drawings, the location of outlets or devices, from finished floor to center of plate or device, shall be as follows:

1. Lighting switches: 48 inches.

2. Thermal switches: 48 inches.

3. Receptacles: 16 inches.

4. Telephone outlets: 16 inches.

5. Fire alarm stations: 48 inches.

6. Fire alarm horn/light signals: 7 feet, 6 inches.

7. Clocks: 7 feet, 8 inches.

B. Unless otherwise shown on the Contract Drawings, the location of equipment, from finished floor to top of enclosures shall not exceed 6 feet, 6 inches.

1. In exposed or public locations, panelboards and cabinets shall generally be flush mounted and all covers shall be identical in layout and size, and shall be installed to maintain a level and straight top and bottom alignment.

2. In concealed locations, or in closets or electrical or mechanical rooms, or non-public locations, panelboards and cabinets shall generally be surface mounted and shall be installed to maintain a level and straight top alignment.

3.04 DISSIMILAR METALS

A. Dissimilar metals shall mean those metals which are incompatible with one another in the presence of moisture, as determined from their relative positions in the Electrochemical Series, or from test data. Where dissimilar metals come in contact, paint the joint both inside and out with approved coating so as to exclude moisture from the joint, or provide a suitable insulating barrier separating the metals.

B. Transitions in raceways, from one metal to a dissimilar metal shall only be made at boxes or other enclosures, except where shown on the Contract Drawings.

3.05 NAMEPLATES

Secure nameplates on equipment or walls with stainless steel or brass screws.

3.06 RUBBER MATS

A. Install rubber mats in front of each panelboard, switchboard, motor control center, switchgear and substation transformers, and along each side and the end or each generator set, or as shown on the Contract Drawings.

B. Rubber mats when installed shall lay flat without curling.

3.07 CUTTING AND PATCHING

A. Perform all cutting and patching of existing construction required for installation of all materials and equipment as specified in this Division.

B. Perform all patching to match existing adjacent construction to the satisfaction of the Engineer and using the best possible workmanship of the various trades involved.

3.08 FINAL FIELD TESTS

A. The entire electrical installation shall be inspected prior to final acceptance testing, thoroughly cleaned, and damaged finishes touched up after final completion and prior to final acceptance testing being performed. Not less than 30 days prior to the testing, furnish a test plan, to the Engineer for review, outlining all aspects of the testing, including tests to be performed and the expected results.

B. Perform the following field test in the presence of the Engineer to demonstrate the reliability of the electrical installation. Give the Engineer a minimum of one week advance notice of such tests.

1. Operate all electrical systems and equipment for a period of 24 hours, unless in the opinion of the Engineer, a different test period is required, to prove the operation and performance of a system and its equipment.

2. Should the foregoing test reveal any defects, promptly correct such defects and re-run the tests until the entire installation conforms to the requirements of these Specifications and the Contract Drawings.

C. Tests requiring certified reports and those requiring factory or field inspection shall be conducted and reported to the Engineer in conformance with standards herein specified.

D. In addition to the tests outlined above, after completion of the electrical system and prior to occupancy:

1. The following equipment and devices, as a minimum, shall be thermographically inspected utilizing a Hughes Aircraft Probeye infrared detector, or approved equal, with videotaping attachment.

a. High voltage cable splices and connections.

b. Switchboard.

c. Transformer.

d. Switchgear.

e. Panelboards.

f. Motor Control Centers.

g. Automatic transfer switch and emergency power system connections.

h. Chiller motor and starter connections.

i. All 600 volt (nominal) cable connections rated 100 amperes (#3 AWG) or greater.

j. Other equipment as shown on the Contract Drawings.

2. The inspection shall be made by an independent inspection company such as Thermo-Scan, Montville, N.J., General Electric Apparatus Service Division, or approved equal. The inspection shall be made with all equipment, motors, lighting fixtures, and miscellaneous loads operating and with all equipment covers removed. Inspection reports complete with color photographs of the infrared scan and control photographs indicating the ambient temperature and any hot spots of each item inspected shall be submitted to the Engineer for approval. Any equipment, connections or devices indicated to be operating improperly performing equipment shall be replaced or repaired by the Contractor at no cost to the Authority. The cost of the inspections and necessary repairs shall be included in the Contract.

E. Demonstrate to the Engineer equipment or systems installed or modified in this Contract.

1. After completion of all testing, and prior to placing equipment or systems in operation, demonstrate the features and operation of the equipment or systems to the Engineer, and all other staff or interested parties, as designed by the Engineer, so that operational and maintenance personnel are familiarized with the equipment and systems, as follows:

a. Switchboards and panelboards.

b. Transformer.

c. Switchgear.

d. Motor control centers.

e. Fire alarm and smoke detection systems.

f. Automatic transfer switches

g. Standby/Emergency generator sets.

h. Other equipment as shown on the Contract Drawings.

2. Provide the necessary accessories, test equipment, and personnel, for each demonstration.

3. Complete all arrangements for the demonstrations through the Engineer.

4. Upon the completion of each demonstration or instructional session, obtain "sign-off" from the Engineer. The "sign-off" shall state that the demonstration or instructions for use were provided, that they were complete and were given to the designated personnel.

3.09 TRAINING AND MANUALS

A. Provide training for Authority personnel through scheduled training courses for the purpose of providing a working knowledge of systems and equipment installed as approved by the Engineer. The training shall cover operation, maintenance and repair of the systems and equipment.

1. The basic text to be used for training shall consist of "As Built" drawings and a Maintenance Manual approved by the Engineer for the Authority maintenance staff and an Operations Manual approved by the Engineer for operations personnel.

2. Utilize the basic text outline above to prepare for approval by the Engineer separate training agendas and course outlines for the maintenance staff and operationals personnel.

3. After approval of training manuals and course outlines, provide not less than two, eight-hour classroom sessions for operation and maintenance personnel which shall include operations, trouble-shooting, debugging, repair procedures, preventive maintenance procedures, and parts replacement.

4. All training shall be provided and completed prior to the commencement of the operational test.

B. All instructions and manuals shall be approved by the Engineer. A draft form of the manuals shall be delivered to the Engineer ten (10) calendar days prior to the commencement of the shop/factory test if required and if not required with ten (10) days prior to the Final Test. The manuals shall be finalized, subject to revision, prior to the commencement of the operational test. All other documentation items shall be provided prior to the completion of the work.

1. Instruction

Prepare a separate comprehensive training curriculum to instruct Authority personnel in operation and maintenance of the equipment and components. Such instruction shall include, but not be limited to the following:

a. Operation Instruction

1) Description of units and component parts.

2) Start-up, regulation, control, shut-down, and emergency instructions.

3) Recommendations for types of cleaning agents and methods, including cautions against detrimental agents and methods.

4) Operating manual shall describe the operation as it relates to user's tasks and shall constitute the basis of instruction.

b. Maintenance Instruction

1) Operation of all system components.

2) Complete description and demonstration of all diagnostic procedures and equipment, such as adjustment, checking, disassembly, repair and reassemble, and guide to "troubleshooting" and problem solving and schedule of preventive maintenance procedures.

3) Maintenance manual shall constitute the basis of instruction.

2. Manuals

Prepare complete, separate, operation and maintenance manuals. Provide information for products specified in this Section and prepare in the form of manuals with an index of contents. Contents shall include as appropriate, but not be limited to:

a) Configuration block diagrams.

b) Scaled layout drawings of floor plans indicating equipment locations.

c) Inventory of all hardware including the manufacturers' name, model number, serial number, name plate data, and overall dimensions.

d) Detailed installation wiring diagrams and cabling diagrams of the system "as built".

e) All terminal markings, cable connector markings, and cable lengths.

f) Guidelines for locating faults, isolating the cause of the malfunction, and for the removal, repair, and replacement of all hardware.

g) A chart of common symptoms with suggested remedial action.

h) Complete and detailed operating instructions for all system functions.

END OF SECTION

SECTION 16110

RACEWAYS

PART 1 - GENERAL

1.01 SUMMARY

This Section specifies requirements for raceways.

1.02 REFERENCES

The following is a listing of the publications referenced in this Section:

American National Standards Institute (ANSI)

ANSI C 80.1 Rigid Steel Conduit - Zinc Coated

ANSI C 80.3 Electrical Metallic Tubing - Zinc Coated

ANSI C 80.5 Rigid Aluminum Conduit

National Electrical Manufacturers Association (NEMA)

NEMA FB 1 Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit and Cable Assemblies

National Fire Protection Association (NFPA)

NFPA 70 National Electric Code

Underwriters Laboratories Inc. (UL)

UL 1 Flexible Metal Conduit

UL 5 Surface Metal Raceways and Fittings

UL 6 Rigid Metal Conduit

UL 360 Electrical Liquid-tight Flexible Steel Conduit

UL 514B Fittings for Conduit and Outlet Boxes

UL 797 Electrical Metallic Tubing

UL 870 Wireways, Auxiliary Gutters, and Associated Fittings

UL 884 Underfloor Raceways and Fittings

UL 1242 Intermediate Metal Conduit

1.03 QUALITY ASSURANCE

Raceways, of types and sizes required, shall have been satisfactorily used for purposes similar to those intended herein for not less than three years.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Deliver material in manufacturer's original, unopened, protective packaging. Protective caps shall be removed immediately prior to installation of conduit.

B. Store materials in a clean, dry space and protect them from weather.

C. Handle in a manner to prevent damage to finished surfaces.

1.05 SUBMITTALS

Submit the following in accordance with the requirements of "Shop Drawings, Catalog Cuts, and Samples" of Division 1 - GENERAL PROVISIONS:

A. Shop Drawings

Raceway systems - only when shop drawings are required by the Contract Drawings

B. Catalog Cuts

1. Conduit and Tubing

2. Surface Metal Raceway and Accessories

3. Underfloor Raceway and Accessories

4. Wireways and Auxiliary Gutters

PART 2 - PRODUCTS

2.01 MATERIALS

A. General

1. Locations, types and sizes of raceways are shown on the Contract Drawings.

2. Minimum size of conduit shall be 3/4 inch.

3. Conduit shall be supplied in standard 10-foot lengths in accordance with UL 6.

4. All electrical materials and equipment, for which there are established UL standards, shall bear the UL label.

B. Rigid Metal Conduit

1. GSC - Hot-dipped galvanized steel (thick-wall) conduit shall be threaded and shall conform to UL 6 and ANSI C 80.1.

2. IMC - Intermediate metal conduit, hot-dipped galvanized steel (medium-wall) conduit, shall be threaded and shall conform to UL 1242.

3. ALC - Aluminum conduit shall conform to UL 6 and ANSI C 80.5.

4. All preformed elbows shall be similar in construction to, and of a type designed for use with the appropriate conduit and shall conform to UL 6.

5. All fittings shall be threaded and shall conform to NEMA FB-1.

C. Electrical Metallic Tubing

1. EMT - Electrical metallic tubing (thin-wall) shall be galvanized steel and shall conform to UL 797 and ANSI C 80.3.

2. Unless otherwise shown on the Contract Drawings, all fittings shall be indenter or compression type made of malleable or pressed steel and shall conform to NEMA FB 1.

D. Flexible Metal Conduit

1. FSC - Flexible steel (galvanized) conduit shall conform to UL 1.

2. LSC - Liquid-tight flexible metal conduit shall conform to UL 360.

3. Fittings shall be of a type designed for use with the respective conduit and shall conform to UL 514B.

E. Surface Metal Raceways

1. Surface raceways shall conform to UL 5.

2. Surface metal raceways shall have a complete line of accessories readily available.

F. Underfloor Raceways

1. Duct, fittings, and accessories shall be suitable for encasement in concrete and shall conform to UL 884.

2. Underfloor raceways shall have a complete line of accessories readily available.

G. Wireways and Auxiliary Gutters

1. Wireways and auxiliary gutters shall be seamless galvanized steel construction, hinged cover to be locked with captive screws and shall conform to UL 870.

2. Wireways and auxiliary gutters shall have a complete line of accessories readily available.

H. Fastening Devices

Provide inserts, bolts and washers, or any other type of fastening devices conforming to the requirements of the Section entitled "SUPPORTING DEVICES", required to secure conduits to walls or above hung ceilings. Unless otherwise shown on the Contract Drawings, all fasteners shall be hot-dipped galvanized and of sizes and types recommended by the equipment manufacturer and as approved by the Engineer.

I. Insulated Bushings

Insulated bushings shall be rated 150 degrees C.

PART 3 - EXECUTION

3.01 INSTALLATION

A. General

1. Make all bends in accordance with the manufacturer's recommendations and NFPA 70.

2. Ream conduit ends free from burrs prior to installation, and draw joints up tight.

3. Make transitions in conduit from one metal to a dissimilar metal only at boxes or other enclosures, unless otherwise shown on the Contract Drawings.

4. Install concealed conduits or tubing in as direct a line as possible.

5. Install exposed raceways, located above hung or accessible ceilings, parallel with or at right angles to the lines of buildings and as close to the ceiling as possible, unless otherwise shown on the Contract Drawings.

6. Install expansion fittings in all conduits which cross expansion joints or where conduits attach to independent structures.

7. Securely fasten threaded conduits entering enclosures, other than threaded, cast boxes, by means of two lock-nuts, one on each side of the enclosure. Terminate the conduits in insulated bushings.

8. Seal all free ends of empty conduit to prevent water entrance.

9. For conduit through roofs and external walls of buildings, manholes and other construction, seal openings watertight in a manner approved by the Engineer.

10. Where portions of an interior raceway system are exposed to widely different temperatures, make provisions to prevent circulation of air from a warmer to a colder section through the raceways.

11. Apply red lead paint to all exposed threads after joints have been made up clean and tight.

12. Support all conduits in a manner approved by the Engineer. Supports shall be spaced to prevent sagging of the conduits.

13. All conduit runs shall leave or enter structures perpendicularly.

B. Rigid Metal Conduit

1. Install only rigid metal conduit type GSC in areas classified as hazardous, for fire alarm systems and where shown on the Contract Drawings.

2. Rigid metal conduits to be installed underground shall be concrete encased, unless otherwise shown on the Contract Drawings. Details for encasement are shown on the Contract Drawings. Concrete encasement shall be in accordance with the Section entitled "CONCRETE."

3. IMC may be used in locations other than those prohibited by codes, which would be applicable, if the Authority were a private corporation and where type GSC is not required by 3.01 B.1 above.

C. Electrical Metallic Tubing

EMT used for power feeder or branch circuits, shall not exceed 2-inch trade size. EMT used for control circuits and communications systems shall not exceed 4-inch trade size.

D. Flexible Metal Conduit

1. Install FSC for motor connections and for other equipment connections where subject to movement and vibration. Conduit shall be installed to permit maximum flexibility,

without crushing or permanent deformation, and shall not exceed 18 inches in length, without approval of the Engineer.

2. Use LSC for the same installation conditions as FSC above, and where also subjected to one or more of the following conditions:

   a. Exterior locations;

   b. Condensating, moist, wet or humid conditions;

   c. Corrosive atmospheres;

   d. Water spray;

   e. Dripping oil, grease or water.

3. Install FSC and LSC with a separate, insulated copper, code-sized equipment grounding conductor, installed either inside or outside the flexible conduit.

E. Surface Metal Raceways

1. Only metallic surface metal raceways will be permitted, unless otherwise shown on the Contract Drawings. Installation shall be in accordance with manufacturer's written recommendations and instructions accompanying the raceways.

2. Provide surface raceway system with means for assuring a continuous ground path throughout.

3. Use fittings without sharp edges introduced into any part of the raceway system.

F. Underfloor Raceways

1. Install underfloor raceways in accordance with NFPA 70 and the recommendations and requirements of the manufacturer and the listing agencies, including, but not limited to UL, Factory Mutual (FM) or Electrical Testing Laboratories (ETL).

2. Power and communications outlets shall be the types and model numbers as shown on the Contract Drawings.

3. Provide power and communications outlets with "Palucell" packets, as shown on the Contract Drawings. No substitutions will be permitted.

G. Dissimilar Metals

1. "Dissimilar metals" shall mean those metals which are incompatible with one another in the presence of moisture, as determined from their relative positions in the Electrochemical Series, or from test data.

2. Where dissimilar metals come in contact, paint the joint both inside and out with approved coating to exclude moisture from the joint, or provide a suitable insulating barrier separating the metals.

3.02 FIELD TESTS

A. Conduit Cleaning and Testing

1. After installation of conduits and accessories and completion of all concreting operations, if any, carefully clean and clear all conduit runs of all obstructions and foreign matter to the satisfaction of the Engineer.

2. Test conduits, in the presence of the Engineer, by pulling through each conduit a flexible cylindrical mandrel having an outside diameter not more than 1/4 inch smaller than the inside diameter of the conduit, but nominally 85 percent of the trade diameter, whichever is larger. Only nylon cable of adequate strength shall be used to pull the mandrel through the conduit system. The use of rope will not be permitted.

B. Connections to Existing Conduits

1. Where conduits installed under this Contract are connected to existing conduits, or conduits installed by others, test the entire run to the nearest box, manhole, handhole, or equipment enclosure as specified in 3.02 A.2 above.

2. Report immediately to the Engineer any defect or stoppage found in portions of the conduit system not installed under this Contract. Do not attempt to rectify any defect or stoppage found in conduit not installed under this Contract unless specifically instructed to do so by the Engineer. The Contractor's compensation for the rectifying of such defects or stoppages at the direction of the Engineer will be determined in accordance with the clause of the Contract providing compensation for Extra Work.

3. The Engineer shall be the sole judge as to whether a defect or stoppage exists. Perform all tests required by the Engineer to enable him to make his decision.

END OF SECTION

A REVISED 10/21/92

DIVISION 16

SECTION 16120

WIRES, CABLES, SPLICES, TERMINATIONS (600 VOLTS OR LESS)

PART 1 - GENERAL

1.01 SUMMARY

This Section specifies requirements for wires, cables, splices, terminations, and appurtenances for electrical systems of 600 volts or less.

1.02 REFERENCES

The following is a listing of the publications referenced in this Section:

American Society for Testing and Materials (ASTM)

ASTM B 1	Hard-Drawn Copper Wire
ASTM B 2	Medium-Hard-Drawn Copper Wire
ASTM B 3	Soft or Annealed Copper Wire
ASTM B 8	Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft
ASTM B 33	Tinned Soft or Annealed Copper Wire for Electrical Purposes
ASTM B 174	Bunch-Stranded Copper Conductors for Electrical Conductors
ASTM B 189	Lead-Coated and Lead-Alloy-Coated Soft Copper Wire for Electrical Purposes
ASTM D 1373	Medium-Voltage Rubber Insulating Tape
ASTM D 2802	Ozone-Resistant Ethylene-Propylene-Rubber Insulation for Wire and Cable
ASTM D 3005	Low-Temperature Resistant Vinyl Chloride Plastic Pressure-Sensitive Electrical Insulating Tape

Federal Specifications (FS)

HH-I-553	Insulation Tape, Electrical (Rubber, Natural and Synthetic)

Insulated Cable Engineers Association (ICEA)

ICEA S-19-81	Rubber-Insulated Wire and Cable for the Transmission and Distribution of Electrical Energy (NEMA WC 3)
ICEA S-61-402	Thermoplastic-Insulated Wire and Cable for the Transmission and Distribution of Electrical Energy (NEMA WC 5)
ICEA S-66-524	Cross-Linked-Thermosetting-Polyethylene-Insulated Wire and Cable for the Transmission and Distribution of Electrical Energy (NEMA WC 7)
ICEA S-68-516	Ethylene-Propylene-Rubber-Insulated Wire and Cable for the Transmission and Distribution of Electrical Energy (NEMA WC 8)

Institute of Electrical and Electronics Engineers (IEEE)

IEEE 383	Type Test of Class 1E Electric Cables, Field Splices and Connections for Nuclear Power Generating Stations
IEEE 837	Standard for Qualifying Permanent Connections Used in Substation Grounding

National Fire Protection Association (NFPA)

NFPA 70	National Electrical Code
NFPA 258	Standard Research Method for Determining Smoke Generation of Solid Materials

Underwriters Laboratories Inc. (UL)

UL 44	Rubber-Insulated Wires and Cables
UL 62	Flexible Cord and Fixture Wire
UL 83	Thermoplastic-Insulated Wires and Cables
UL 467	Grounding and Bonding Equipment
UL 510	Insulating Tape
UL 854	Service-Entrance Cables
UL 1581	Reference Standard for Electrical Wires, Cables, and Flexible Cords

1.03 QUALITY ASSURANCE

A. Wires and cables which have been manufactured more than two years prior to installation shall not be used in the Work of this Section.

B. Tapes for splices or terminations shall be dated by the tape manufacturer to indicate that they have been manufactured no longer than six months prior to use in the Work of this Section.

C. Polyvinyl Chloride (PVC): PVC-insulated power wiring and items containing PVC, except PVC-insulated wiring for communications systems, remote control, signaling, and power-limited circuits, shall not be installed in any indoor area. PVC-insulated wiring for communications systems, remote control, signaling, and power-limited circuits shall be furnished and installed in accordance with NFPA 70.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Single conductor wire or cable sizes #4/0 AWG and larger that are to be installed in the same raceway shall be paralleled by the cable manufacturer prior to shipment. Cable assembly overall diameter shall be kept to a minimum.

B. Wire and cable sizes #4/0 AWG and larger shall be provided with factory-applied caps unless otherwise shown on the Contract Drawings. End seals shall be heat-shrink, irradiated, modified polyolefin, and shall be sized for individual wires and cables.

C. Store material in a clean, dry space and protect from weather.

1.05 SUBMITTALS

A. Submit Catalog Cuts for the following in accordance with the requirements of "Shop Drawings, Catalog Cuts, and Samples" of Division 1 - GENERAL PROVISIONS:

1. Wires and cables for each type and size;

2. Splice kit materials and installation procedures.

B. Submit certified shop test reports for wires and cables.

C. Submit field test results for wires and cables, including "Megger" readings with the method used.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

Subject to compliance with requirements of this Section, provide wires, cables, wire and cable splicing, terminating and arcproofing materials of one of the following manufacturers, or approved equal:

A. Wires and Cables

1. American Insulated Wire Corporation
2. Pirelli Cable Corporation
3. Okonite Company
4. BIW Cable Systems, Inc.
5. Rome Cable Corporation
6. Triangle PWC, Inc.
7. Cablec Insulated Cable Company
8. Brand Rex Company

B. Cable Splicing, Terminating and Arcproofing Materials

1. Square D Company
2. Thomas and Betts Corporation
3. Burndy Corporation
4. Cadweld (Erico Products Inc.)
5. Raychem Corporation
6. Minnesota Mining and Manufacturing Company (3M)
7. MAC Products Inc.
8. Bishop Electric Corporation
9. Plymouth Rubber Company, Inc.
10. Okonite Company

2.02 WIRES AND CABLES

A. General

1. Locations, types, sizes and numbers of wires and cables are shown on the Contract Drawings.

2. Unless otherwise shown on the Contract Drawings, solid conductors shall be soft or annealed copper, conforming to ASTM B 33 (tinned), ASTM B 189 (lead-coated or lead-alloy coated), or ASTM B 3 (uncoated). Unless otherwise specified in this Section or unless otherwise shown on the Contract Drawings, stranded copper conductors shall be concentric stranding conforming to ASTM B 8.

3. Color-Coding for Power and Lighting Conductors

   a. Insulation or covering of wires and cables shall be factory color-coded by the use of colored compounds or coatings. The color-code shall be followed consistently throughout the performance of the Work.

   b. Upon written request of the Contractor, the Engineer may permit the use of the following methods in lieu of the wire or cable manufacturer's color-coding, when limited quantities of wire and cable are involved, for sizes #8 AWG and larger.

      (1) For dry locations only, spiral application of 3/4 inch wide, colored pressure sensitive plastic tape, half lapped for a distance of not less than six inches may be used. To prevent unwinding, the last two wraps of tape shall be applied with no tension.

      (2) For wet or dry locations, application of three, 3/16 inch wide, colored, fungus-inert, self-extinguishing, self-locking, nylon cable ties spaced 3 inches apart may be used. The ties shall be snugly applied with a special tool or pliers, and any excess removed.

      (3) Each wire and cable shall be color-coded at all terminal points, in all manholes, boxes, or other similar enclosures.

      (4) Color markings shall be applied so as not to obliterate the manufacturer's identification markings.

   c. Color code chart shall be as follows:

	System Voltage	
Conductor	208Y/120V	480Y/277V
Phase A	Black	Brown
Phase B	Red	Orange
Phase C	Blue	Yellow
Neutral	White	Gray
Ground	Green	Green

4. All wires, cables, splices and terminations, for which there are established UL standards, shall bear the UL label.

B. General-Purpose Wires and Cables

1. General-purpose wires and cables shall be single conductor, ASTM B 8, Class B stranded for sizes #8 AWG and larger, and solid for sizes #10 AWG and smaller.

2. Unless otherwise shown on the Contract Drawings, general-purpose wires and cables for interior use shall be low smoke, low toxicity, non-halogen, flame-retarding type. Cablec "RHH-VW-1 Non-Halogen", Pirelli "Pirelliflex-Afumex Type TC (XHHW-VW-1)", BIW "Lo-Smoke", or approved equal.

3. Where shown on the Contract Drawings, wires or cables shall be:

   a. Type XHHW: Cross-linked-thermosetting-polyethylene insulation, conforming to UL 44, interior use.

   b. Type FEP: Fluorinated-ethylene-propylene insulation, conforming to UL 83, interior use.

   c. Type USE: Ethylene-propylene-rubber insulation, with heavy-duty thermosetting chloro-sulphonated polyethylene or heavy-duty neoprene jacketed, multiple rated "USE-RHH-RHW", conforming to ASTM D 2802, ICEA S-68-516, UL 44 and UL 854, interior or exterior use.

4. Unless otherwise shown on the Contract Drawings, cross-linked-thermosetting-polyethylene insulation shall not be provided for installations which may be subject to moisture or where installed below grade.

5. Type SF-2 shall be provided where high temperature wire or cable is shown on the Contract Drawings.

C. Aerial Cables

Two or more Type SE, ASTM B 8, Class B or Class C stranded, hard-drawn copper conductors, ethylene-propylene-rubber insulation, with heavy duty neoprene or heavy duty thermosetting chloro-sulphonated polyethylene jacketed, marked "sunlight resistant", conforming to ASTM D 2802, UL 44 and UL 854. Cable shall be factory assembled with copper-clad messenger conforming to ICEA S-68-516.

D. Portable Cords

1. Type S shall be 60 degrees C rated, with heavy-duty thermosetting insulation and jacket, conforming to UL 62, 600-volt rated.

2. Type SO shall be oil resistant, 60 degrees C rated, with heavy-duty thermosetting insulation and jacket, conforming to UL 62, 600-volt rated.

3. Type G or Type W shall be 90 degrees C rated, with ethylene-propylene-rubber insulation and Hypalon jacket, 600-volt rated.

4. Special types shall be used only where shown on the Contract Drawings.

E. Lighting Fixture Wires

Unless otherwise shown on the Contract Drawings, lighting fixture wires shall be stranded only, and shall be Type SF-2, silicone rubber insulated conforming to UL 62.

F. Grounding Wires and Cables

Unless otherwise shown on the Contract Drawings, grounding conductors shall be as follows:

1. Insulated

a. Solid for sizes #8 AWG and smaller; ASTM B 8, Class B stranded for sizes #6 AWG and larger; and of the same insulation type as the power conductors.

b. Covering shall be a continuous green color and conform to ASTM B 33 and UL 44.

2. Uninsulated

a. General

Solid for sizes #8 AWG and smaller; ASTM B 8, Class B stranded for sizes #6 AWG and larger.

b. In raceways

Soft-drawn and conforming to ASTM B 3.

c. Direct buried or encased in concrete

Soft-drawn, medium-hard-drawn, or hard-drawn and conforming to ASTM B 1, B 2 or B 3, respectively.

G. Control Wires and Cables

1. Single conductor wires and cables shall be ASTM B 8, Class B stranded, 600-volt, sizes as shown on the Contract Drawings, Type XHHW cross-linked-thermosetting-polyethylene insulation, conforming to UL 44 and ICEA S-66-524.

2. Multiconductor cables shall be ASTM B 8, Class B or Class C stranded, Control Cable Type B, conforming to ICEA S-61-402, color-coded as per ICEA S-61-402, Method No. 1 for NFPA 70 applications (with white and green) or ICEA S-19-81, for color-coding paired conductor cables.

   a. Wires and cables for interior use shall be either of the following types:

      (1) Flame-retardant, low smoke density rating, ethylene-propylene-rubber insulation with overall heavy-duty thermosetting jackets conforming to ICEA S-68-516, UL 44, and UL 1581. The jacket shall not exceed a smoke density rating DM (specific optical density) of 232 and 292 maximum in the flaming and non-flaming modes, respectively, of NFPA 258.

      (2) Ethylene-propylene-rubber insulation with individual and overall heavy-duty thermosetting jackets, conforming to ICEA S-68-516 and vertical tray flame test of IEEE 383.

   b. Wires and cables for exterior use shall be either of the following types:

      (1) Polyethylene insulation with individual and overall polyvinyl chloride jackets, conforming to ICEA S-61-402.

      (2) Cross-linked-thermosetting-polyethylene insulation with overall polyvinyl chloride jackets, conforming to ICEA S-66-524 and vertical tray flame test of IEEE 383.

H. Switchboard Wires and Cables

1. Switchboard wires and cables shall be single conductor, ASTM B 8, Class B stranded, except that for wires and cables crossing hinged joints and swinging panels, and where "Extra Flexible" wire or cable is shown on the Contract Drawings, conductors shall be ASTM B 174, Class K stranded.

2. Wires and cables shall be Type SIS, cross-linked-thermosetting-polyethylene insulation, conforming to ICEA S-61-402, IEEE 383 and UL 44.

I. Cable Tags

1. Dry Locations

a. Fiberglass tags, 1/16 inch thick and 3/4 inch wide, indented with letters and numbers 5/16 inch high, with #14 AWG copper or nylon, weather-resistant cable ties.

b. Lighting branch circuit wiring and single conductor signal and control wiring may be identified with "Quiklables" manufactured by W. H. Brady Company, or approved equal.

2. Wet Locations

Stainless steel metal tags, No. 28 gauge and 3/4 inch wide, embossed with letters and numbers 5/16 inch high, with #14 AWG copper or nylon, weather-resistant cable ties, or stainless steel cable ties.

2.03 SPLICING, TERMINATING AND ARCPROOFING MATERIALS

A. General

1. All splicing, terminating and arcproofing materials shall be compatible so that no one material will adversely affect the physical or electrical properties of any other, or of the wire or cable itself.

2. All materials for making splices and terminations shall be specifically designed for use with the type of wire or cable, insulation and installation and operating conditions of the specific application.

B. Connectors

Subject to compliance with requirements of this Section, provide connectors of the following types:

1. Solderless, uninsulated, high conductivity, corrosion resistant, compression connectors conforming to UL 467 and IEEE 837;

2. Insulated, indenter type compression butt connectors;

3. Insulated, integral self-locking flexible shell, expandable spring connectors;

4. Uninsulated, indenter type compression pigtail connectors;

5. Welded type connectors.

C. Terminals

Subject to compliance with requirements of this Section, provide terminals of the following types:

1. Solderless, uninsulated, high conductivity, corrosion resistant, compression terminals conforming to UL 467 and IEEE 837;

2. Insulated, compression terminals;

3. Solderless, high conductivity, corrosion resistant, hex screw type, bolted terminals;

4. Welded type terminals.

D. Shrinkable Tubing

Subject to compliance with requirements of this Section, provide shrinkable tubing of the following types:

1. Either irradiated modified polyvinyl chloride or irradiated modified polyolefin heat shrinkable tubing;

2. Cold shrinkable tubing.

E. Tapes and Sealers

1. Vinyl Tapes

Flame-retardant, cold and weather-resistant, 3/4 inch or 1 1/2 inches wide, as required, and conforming to UL 510 and ASTM D 3005.

a. For interior, dry locations, provide 7 mils, conforming to ASTM D 3005 (Type I); Scotch (3M) No. 33, or approved equal.

b. For exterior or damp and wet locations, provide 8.5 mils, conforming to ASTM D 3005 (Type II); Scotch (3M) No. 88, or approved equal.

2. Rubber Tapes

Ethylene-propylene, rubber-based, 30-mil splicing tape, rated for 130 degrees C operation; 3/4 inch and wider (1, 1 1/2, 2 inches) as shown on the Contract Drawings or approved by the Engineer, conforming to ASTM D 1373 and Federal Specification HH-I-553 (Grade A); Scotch (3M) No. 130C, or approved equal.

3. Insulating Putty

Rubber-based, 125-mil elastic filler putty; 1 1/2 inches wide; Scotch (3M) Scotchfil, or approved equal.

4. Silicone Rubber Tapes

Inorganic silicone rubber, 12-mil, 130 degrees C rated, anti-tracking, self-fusing tape; 1 inch wide; Scotch (3M) No. 70, or approved equal.

5. Sealer

Liquid applied, fast-drying sealant; Scotch (3M) Scotchkote, or approved equal.

F. Resin Filled Splices

1. Epoxy Molded Type

Two-piece, snap-together molded bodies, sized for wire or cable, with two-part low viscosity polyurethane insulating and sealing compound, rated for 600 volts, using crimp-type wire connector; Scotch (3M) No. 87-A1, 87-A2 or 87-A3 compound, or approved equal.

2. Re-Enterable Type

Transparent, molded bodies clamped with stainless steel strain-relief bar and shield continuity connectors, sized for wire or cable, with loosely woven polyester spacer web and jelly-like urethane formulation for permanent re-entry capability; Scotch (3M) No. 78-R1 thru 78-R5, with No. 2114 compound, or approved equal.

G. Arcproofing Materials

1. Fire resistant tapes shall be Scotch (3M) No. 77, or approved equal.

2. Glass cloth binding tapes shall be Scotch (3M) No. 69, or approved equal.

H. Special splicing materials and methods shall be as shown on the Contract Drawings.

2.04 SHOP TESTS

A. For quantities as shown on the Contract Drawings, regular dielectric-withstand and insulation-resistance in water tests for wires and cables shall be performed in accordance with UL 44.

B. Flame tests for wires and cables shall be performed in accordance with IEEE 383.

C. The test results shall be certified for each reel/coil/box of wire or cable.

D. Factory inspection and witnessing of tests by the Engineer shall be required for all wires and cables furnished under this Contract. The Engineer reserves the right to require additional testing, or to waive factory inspection or witnessing of tests. The Contractor shall notify the Engineer 14 days in advance of the scheduling of such factory tests.

PART 3 - EXECUTION

3.01 PREPARATION

A. Prior to pulling wires and cables, clean raceway systems of all foreign matter and perform all operations necessary so as not to cause damage to wires and cables while pulling.

B. Prior to pulling wires and cables into underground conduit systems, place a feeding tube approved by the Engineer at the entrance end of such systems.

3.02 INSTALLATION

A. Wire and Cable Installation

1. General

a. Keep wires and cables dry at all times.

b. Seal wire and cable ends with watertight end seals if splicing or terminating does not follow at once.

c. Before splicing or terminating wires and cables, make a thorough inspection to determine that water has not entered the wires and cables or that the wires and cables have not been damaged.

d. Use adequate lubrication when installing cables in conduits or raceways. Any pulling compounds shall be compatible with the finish of the wires and cables furnished.

2. General Purpose Wires and Cables

a. No wire or cable smaller than #12 AWG shall be used for light and power service.

b. Wires or cables shall be at least #10 AWG for the entire length of branch circuits, where distances to first outlets are as follows:

(1) 100 feet or more on 480Y/277 Volt systems.

(2) 70 feet or more on 208Y/120 Volt systems.

3. Lighting Fixture Wires

a. For wiring within lighting fixtures only, where sizes #14 AWG or smaller are required, use Type SF-2 fixture hookup wire. Type SF-2 wire shall not be used for wiring end-to-end connected fluorescent fixtures.

b. For connecting lighting fixtures to branch circuit conductors, use either Type RHH-VW-1, XHHW or USE, up to 90 degrees C, in dry locations.

4. Grounding Wires and Cables

a. Use bare, uninsulated wire and cable only where shown on the Contract Drawings or where approved by the Engineer.

b. Insulated grounding cable shall be of the type specified in this Section or as shown on the Contract Drawings.

5. Control Wires and Cables

Control wires and cables shall not be smaller than #14 AWG unless otherwise shown on the Contract Drawings.

B. Splicing and Terminating

1. General

Splicing and terminating shall be as specified in this Section. Details of special splicing and terminating shall be as shown on the Contract Drawings. Any splicing or terminating methods other than those specified below, for which the components are in accordance with the requirements of this Section, shall be submitted to the Engineer for approval.

2. General Purpose Wires and Cables

a. Splices in dry locations for sizes #10 AWG and smaller

Splicing shall be completed using one of the following:

(1) Insulated, integral, self-locking flexible shell, expandable spring connectors shall be applied to the twisted conductors. Two, half-lapped layers of vinyl tape, extending to a distance of not less than one inch from the connector, shall be applied.

(2) Compression type, insulated butt connectors shall be applied to the butted conductors by means of an appropriate crimping tool, providing controlled indentation. Two, half-lapped layers of vinyl tape, extending to a distance of not less than one inch from the connector, shall be applied.

(3) Compression type, pigtail connectors shall be applied to the conductors by means of an appropriate crimping tool, providing controlled indentation. The connector shall be covered with a polyamide cap and two, half-lapped layers of vinyl tape, extending to a distance of not less than one inch from the connector, shall be applied.

b. Splices in dry locations for sizes #8 AWG and larger

Splicing shall be completed using all of the following:

(1) Connectors shall be split sleeve solderless type or solderless compression type.

(2) Fill indents of connectors with Scotchfil.

(3) Apply rubber splicing tape equal to the original insulation rating.

(4) Apply two, half-lapped layers of vinyl tape, or a shrinkable tubing.

c. Splices in wet locations

(1) Same as dry locations specified in 3.02 B.2.a and 2.b, except that after vinyl tape is applied, cover with two coats of sealer or shrinkable tubing.

(2) Resin-filled splice shall be covered with two, half-lapped layers of vinyl tape and two coats of sealer or shrinkable tubing.

d. Terminations in dry locations for sizes #10 AWG and smaller

Terminations shall be compression terminals, insulated or uninsulated.

e. Terminations in dry locations for sizes #8 AWG through #3/0 AWG

(1) Ring tongue terminals shall be solderless, uninsulated compression crimp type.

(2) Ring tongue lugs shall be bolted hex screw type.

f. Terminations in dry locations for sizes #4/0 AWG and larger

Ring tongue terminals shall be solderless, uninsulated compression crimp type.

g. Terminations in wet locations

In addition to the dry location terminations specified in 3.02 B.2.d, 2.e and 2.f, cover the entire termination area with two, half-lapped layers of vinyl tape and apply two coats of sealer over the tape.

3. Aerial Cables

Splices and terminations in aerial cables shall be the same as specified in 3.02 B.2.c and 2.g, respectively.

4. Portable Cords

a. Splices shall not be made in portable cords.

b. Terminations shall be made only at apparatus to be served or at branch circuit connection by means of any of the following:

(1) Insulated, integral, self-locking flexible shell, expandable spring, or crimp type connectors;

(2) Insulated, crimp type, compression connectors;

(3) Uninsulated, ring tongue terminals for connection to wire terminal strip block.

5. Lighting Fixture Wires

Connections to branch circuit and to fixture wiring shall be made by either insulated, integral, self-locking flexible shell, expandable spring, or crimp type connectors.

6. Grounding Wires and Cables

a. Splices and terminations shall be installed in accordance with the manufacturer's recommendations.

b. In hazardous or classified locations, splices and terminations shall be solderless high conductivity, corrosion resistant, compression type connectors and terminations shall be clamp type pressure connectors, suitable for such use.

c. All underground connections shall be covered with two coats of asphalt base paint.

7. Control Wires and Cables

   a. Splices shall be made in accordance with the requirements specified in 3.02 B.2.c and shall be enclosed in a re-enterable splicing case. Where shielded cable is shown on the Contract Drawings, the shielding shall be continued through the splice. Shields shall be grounded at one location only unless otherwise shown on the Contract Drawings.

   b. Terminations shall be insulated, indenter type ring tongue terminals.

8. Switchboard Wires

   a. No splices are permitted.

   b. Terminations shall be insulated, indenter type ring tongue terminals.

C. Arcproofing

1. Arcproofing shall be applied where shown on the Contract Drawings.

2. Arcproofing, which has been disturbed for any reason, shall be reinstalled as soon as possible after the disturbance.

3. Arcproofing shall be installed as follows:

   a. Wires and cables shall be grouped by circuit and arcproofing applied over the group of wires and cables comprising one circuit. Splices shall be arcproofed individually and the taping shall join with and be overlapped by the group taping.

   b. Arcproofing shall be applied in two wrappings of half-lapped tape, bound with glass cloth tape applied at the ends of the fire resistant tape, and at intervals not to exceed 24 inches along the entire length of the cables. The two wrappings shall be applied with opposing-lays.

   c. Arcproofing shall be extended into the conduit opening or end bell of the raceway entering a handhole, manhole or box.

   d. Arcproofing tape shall be 1 1/2 inches wide where the diameter of the individual cable, or of the circumscribed circle for the circuit group, is less than 1 3/4 inches. For larger diameters, the tape shall be 3 inches wide.

D. Identification of Wires and Cables

1. Each wire and cable shall be identified by its circuit in all cabinets, boxes, manholes, handholes, wireways and other enclosures and access locations, and at all terminal points.

2. The circuit designations shall be as shown on the Contract Drawings. Tags shall be attached to wires and cables in such a manner as to be readily visible.

3. The tag ties shall be wrapped around all conductors comprising the circuit or feeder to be identified.

4. Wires and cables which are arcproofed shall also be identified outside the applied arcproofing.

3.03 FIELD TESTS

Test all wires and cables installed under this Contract with a 1000-volt Megohmmeter. Furnish the Engineer with a copy of the "Megger" readings together with an outline of the method used. If, in the opinion of the Engineer, any reading is lower than that required by applicable codes, promptly replace the materials involved, at the Contractor's expense, and retest.

END OF SECTION

SECTION 16133

ENCLOSURES, CABINETS, AND TERMINAL BLOCKS

PART 1 - GENERAL

1.01 SUMMARY

This Section specifies requirements for enclosures, cabinets, terminal blocks and accessories.

1.02 REFERENCES

The following is a listing of the publications referenced in this Section:

American National Standards Institute (ANSI)

ANSI Z 55.1 Gray Finishes for Industrial Apparatus and Equipment

National Electrical Manufacturers Association (NEMA)

NEMA 250 Enclosures for Electrical Equipment (1000 Volts Maximum)

National Fire Protection Association (NFPA)

NFPA 70 National Electrical Code

Underwriters Laboratories Inc. (UL)

UL 50 Cabinets and Boxes

1.03 DESIGN AND PERFORMANCE REQUIREMENTS

A. Enclosures/cabinets shall be designed in accordance with requirements of NFPA 70, NEMA 250, and UL 50.

B. Unless otherwise shown on the Contract Drawings, enclosures/cabinets shall meet the following environmental requirements:

1. Enclosures/cabinets located in heated areas shall be NEMA Type 1.

2. Enclosures/cabinets located in unheated areas or in areas subject to dust or oil, shall be NEMA Type 12.

3. Enclosures/cabinets located in exterior areas or subject to rain, dripping liquid, or hosing shall be NEMA Type 4X, stainless steel.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Deliver enclosures/cabinets and separately packaged terminal blocks and accessories in manufacturers' original, unopened, protective packaging.

B. Store enclosures/cabinets and separately packaged terminal blocks and accessories, in original packaging, in a clean, dry space and protect them from weather.

C. Handle in a manner to prevent damage to finished surfaces.

D. Where possible, maintain protective coverings until installation is complete and remove such coverings as part of final cleanup.

E. Touch up any damage to finishes to match adjacent surfaces.

1.05 SUBMITTALS

Submit the following in accordance with the requirements of "Shop Drawings, Catalog Cuts, and Samples" of Division 1 - GENERAL PROVISIONS:

A. Shop Drawings

1. Shop dravings, shoving all mechanical parts and assemblies including electrical components, complete connection details, as vell as a complete list of parts with full identification.

2. Shop drawings for enclosures/cabinets with factory or field mounted terminal blocks, relays or switches.

B. Catalog Cuts

1. Enclosures

2. Cabinets

3. Terminal Blocks

4. Nameplates

5. Other factory or field mounted equipment shown on the Contract Drawings.

C. Schedules

1. Nameplate Nomenclature

2. Terminal Block Designations.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

Subject to compliance with requirements of this Section, provide enclosures and cabinets, terminal blocks and fuses of one of the following manufacturers:

A. Enclosures and Cabinets

ASCO Electrical Products
English Electric Corporation
Hoffman Engineering Company

B. Terminal Blocks

Allen-Bradley Company
Buchanan, Amerace Corporation
Cutler-Hammer Incorporated
General Electric Company
Poweright Products Inc.
Square D Company

C. Fuses

Commercial Enclosed Fuse Company (CEFCO)
Cooper Industries Incorporated/Bussman Division
Gould Incorporated/Circuit Protection Division

2.02 MATERIALS

A. Enclosures/cabinets shall be fabricated of code-gauge, sheet-steel, unless hot-dipped galvanized steel or stainless steel is shown on the Contract Drawings.

B. Terminal block housings shall be molded from flame-retardant Lexan, nylon or polypropylene and terminal block accessories shall be made of flame-retardant materials.

2.03 CONSTRUCTION FEATURES

A. Enclosures/Cabinets

1. Location, size, number and type of enclosures/cabinets shall be as shown on the Contract Drawings.

2. All enclosures/cabinets shall be UL listed and bear UL labels.

3. Enclosures/cabinets for various wiring systems shall provide adequate and proper space for all relays, switches, wires, connections, terminations and taps.

4. Enclosures/cabinets and trims shall be for surface-mounting or recessed installation as shown on the Contract Drawings.

5. Enclosures/cabinets with through wiring shall be arranged to provide side gutters not less than 4 inches wide. Enclosures/cabinets shall be provided with 6-inch wide top and bottom gutters at conduit entry locations.

6. Trim for recessed (or flush) enclosures/cabinets shall consist of a one piece sheet-steel frame with a hinged door, catch and lock. Frame shall be 3/4 inch larger than enclosures/cabinets on all sides and shall be set with its back flush with the finished wall.

7. Enclosures/cabinets for surface-mounting shall be provided with a door, hinged directly to enclosures/cabinets. Door shall be made of one piece of sheet-steel, shall have a 3/4-inch flange around all edges shaped to cover the edge of the box, and shall be provided with a catch and lock. Frames may be secured to the enclosures/cabinets by means of flathead screws with captive nuts or adjustable clamps and shall be self supporting on the cabinet after frame screws have been removed.

8. All doors shall close against a rabbet placed all around the inside edge of the frame, with a close-fitting joint between door and frame. Doors shall be fitted with concealed, continuous, flush piano hinges. Fastening screws on fronts shall be set not over 24 inches apart. Enclosures/cabinets containing terminal blocks, shall have full-sized door openings.

B. Terminal blocks

1. Terminal blocks shall be sized and located as shown on the Contract Drawings.

   a. Solderless box lug terminations shall be rated 600 volts, and sized to accept a wire range of #22 to #8 AWG, with nonrotating clamping surfaces.

   b. Slip-on connectors shall be rated 600 volts, and sized to accept standard 0.25 inch x 0.032 inch connectors and #22 to #12 AWG wires.

c. Fuse blocks, where shown on the Contract Drawings, shall be furnished with Bussmann Type "KTK", or approved equal, 600-volt rated fuses and blown fuse indicator pullers.

d. Provide terminal block accessories, including fanning strips, jumpers, marking strips and terminal covers.

2. Disconnect blocks, where shown on the Contract Drawings, shall be of the isolation type, using the sliding-link disconnect method. The blocks shall be rated 600-volt AC and shall be UL-recognized, Poweright Products Inc. Series SLD-78-S, or approved equal. All terminations to disconnect blocks shall be made with insulated, ring-type compression connectors, Thomas and Betts Corp. Sta-kon Series 'RB', or approved equal.

C. Accessories

1. Enclosures/cabinets shall include terminal straps and brackets, Hoffman Engineering Co. Bulletin A-80, or approved equal, sized for the enclosures/cabinets and designed to space the terminal blocks away from the rear wall of the enclosures/cabinets.

2. Relays, instruments, and other devices, where shown on the Contract Drawings, shall be provided and wired to their respective terminal blocks.

3. Nameplates

a. Provide approved nameplates on the front of each enclosure/cabinet.

b. Unless otherwise shown on the Contract Drawings, fabricate nameplates from an approved type of lamacoid plastic with letters engraved on the plate in white on black background. Where letter sizes are not shown on the Contract Drawings, use 1/2-inch high letters. Nomenclature shall be according to a schedule approved by the Engineer.

c. Secure nameplates on equipment with brass or stainless steel screws.

4. Enclosure/Cabinet Locks

Each locked enclosure/cabinet shall be furnished with a combination catch and flat lock. Locks shall be fitted to separate keying for each system. Furnish one key for each cabinet installed and a maximum of 20 keys per system.

2.04 SHOP PAINTING

A. For nonpublic areas, enclosures/cabinets shall be thoroughly cleaned and degreased before painting, then given a prime coat of zinc chromate paint and two finish coats of enamel paint conforming to ANSI Z 55.1. The gray prime and finish paints shall be a compatible finish system.

B. For all other areas, enclosures/cabinets shall be painted as above, except the color will be selected by the Engineer.

C. Stainless steel or galvanized steel enclosures/cabinets shall not be painted, unless otherwise shown on the Contract Drawings.

PART 3 - EXECUTION

3.01 EXAMINATION

Verify that the electrical installation, structural, and related work performed under other Sections, satisfy the requirements for the performance of the Work of this Section, in accordance with the Contract Drawings and as specified.

3.02 INSTALLATION

A. Enclosures/Cabinets

1. Enclosures/cabinets shall be installed with tops 6 feet-6 inches above the floor, unless otherwise shown on the Contract Drawings.

2. Enclosures/cabinets on unfinished walls shall be set on exposed supporting strut, securely fastened in place by the use of expansion or toggle bolts. Enclosure/cabinet shall be bolted to the supporting strut through the back of the enclosure/cabinet.

3. Enclosures/cabinets on finished walls shall be recessed and fastened by suitable angle irons or channels attached to the structural framework of the building.

4. Cables shall be neatly racked and bundled with nonflammable nylon ties, routed and supported within the enclosures/cabinets or gutters. Minimum bending radii as recommended by cable manufacturers shall not be reduced.

B. Terminal Blocks

1. Terminal blocks may be either factory installed or field installed, at the Contractor's option.

2. The terminal blocks shall be completely assembled on mounting plates with end pieces, and secured in the appropriate enclosures/cabinets by means of stainless steel screws and nuts. No fewer than twenty percent of the active terminal blocks required, but, in any case, no fewer than two spare terminal blocks, shall be provided on each terminal strip.

3. All terminal blocks shall be marked with typewritten or approved labels, with designations approved by the Engineer.

END OF SECTION

SECTION 16140

WIRING DEVICES

PART 1 - GENERAL

1.01 SUMMARY

This Section specifies requirements for wiring devices.

1.02 REFERENCES

The following is a listing of the publications referenced in this Section:

Federal Specifications

W-S-896 (Series) Toggle Switches

Institute of Electrical and Electronics Engineers (IEEE)

IEEE 241 Recommended Practice for Electric Power Systems in Commercial Buildings

National Electrical Manufacturers Association (NEMA)

NEMA WD 1 General Purpose Wiring Devices

NEMA WD 6 Wiring Devices - Dimensional Requirement

National Fire Protection Association (NFPA)

NFPA 70 National Electrical Code

Underwriters Laboratories Inc. (UL)

UL 20 General-Use Snap Switches

UL 498 Electrical Attachment Plugs and Receptacles

UL 917 Clock-Operated Switches

UL 943 Ground-Fault Circuit Interrupters

UL 1054 Special-Use Switches

1.03 QUALITY ASSURANCE

Wiring devices, of types and ratings required, shall have been satisfactorily used for purposes similar to those intended herein for not less than three years.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in manufacturer's original, unopened, protective packaging.

B. Store materials in a clean, dry space and protect them from weather.

C. Handle in a manner to prevent damage to finished surfaces.

D. Where possible, maintain protective coverings until installation is complete and remove such coverings as part of final cleanup.

1.05 SUBMITTALS

Submit catalog cuts for the following in accordance with the requirements of "Shop Drawings, Catalog Cuts, and Samples" of Division 1 - GENERAL PROVISIONS:

A. Receptacles

B. Switches

C. Wallplates

D. Ground-fault circuit interrupter receptacle

E. Poke-through assembly devices

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Subject to compliance with requirements of this Section, provide wiring devices of one of the following manufacturers:

Arrow-Hart Division, Crouse-Hinds Co.

General Electric Co.

Harvey Hubbell Inc.

Leviton Mfg. Co. Inc.

B. All devices for wall system outlets shall be furnished by one manufacturer.

C. All device plates shall be furnished by one manufacturer.

2.02 CONSTRUCTION FEATURES

A. General

1. All wiring devices shall be heavy-duty, specification-grade, conforming to the NEMA configurations and requirements of NEMA WD 1 and UL 498, including the requirements for pressure-blade contacts. NEMA configurations shall be as shown on the Contract Drawings and shall match the requirements of the connected appliances.

2. Locations, types and sizes of wiring devices are shown on the Contract Drawings.

3. All devices shall be one gang wide, except as required for devices rated greater than 20 amperes.

4. All devices shall be terminated with screw terminals or screw-driven pressure clamps. Patented spring or torsion pressure clamps shall not be used.

5. All electrical materials and equipment, for which there are established UL standards, shall bear the UL label.

B. Switches

Switches shall be silent operating type, 20-ampere, 120-277 volt AC, T-rated, flush-mounting, all composition body units, conforming to the requirements of Federal Specification W-S-896 and UL 20, 917 and 1054. Single-pole or double-pole, and 3-way or 4-way devices shall be as shown on the Contract Drawings.

C. Receptacles

1. Duplex convenience receptacles shall be composition body, 125-volt, parallel slot, 2-pole, 3-wire grounding type units with break-off terminal ties for two-circuit application. Receptacles shall be 15-ampere or 20-ampere as shown on the Contract Drawings.

2. Single receptacles shall be 20-ampere, 125-volt, parallel slot, 2-wire grounding type units.

3. Clock outlets shall be single recessed receptacles rated 15-ampere, 125-volt, 2-pole, 3-wire grounding type with a combination plate cover and a clock hanger bracket.

4. Floor service receptacle outlets and fittings shall be of types and ratings as shown on the Contract Drawings. Units shall be constructed of die-cast aluminum, satin finish with 20-ampere, 125-volt, 2-pole, 3-wire grounding type, grey duplex receptacles, installed back to back. Provide with 1-inch NPT, 1-inch long, locking nipple for installation.

5. Factory-assembled "poke-through" assembly device shall be furnished with 15-ampere, 125-volt, 2-pole, 3-wire grounding receptacle and capable of maintaining floor fire rating of 3 hours. Assembly devices shall be suitable for installation in 4 11/16-inch square conduit box in concrete floor, with center tube, five-step wafers, spreader plate and service fitting base plate. Service fitting base plate shall include alignment adjustment screws.

6. "Feed-through" type ground-fault circuit interrupters with heavy-duty duplex receptacle shall be capable of protecting connecting downstream receptacles on single circuit, suitable for installation in a 2 3/4-inch deep outlet box without adapter and of the grounding type in conformance with the requirements of UL 943, for Class A, Group 1; rated 20-ampere, 125-volt, 60 Hertz, with solid-state ground-fault sensing and signalling, and 5 milliamperes ground-fault trip level.

7. Special purpose receptacles as shown on the Contract Drawings shall conform to the requirements of NEMA WD 6.

D. Device Plates

1. All device plates shall be 0.04-inch thick minimum with struck-up beveled edges and free of sharp corners and burrs. All device plates shall be one-piece; sectional plates shall not be used .

2. Unless otherwise shown on the Contract Drawings, all device plates for wall outlets and switches shall be satin finish anodized aluminum.

3. Device plates for wall telephone outlets shall contain a bushed hole.

4. Device plates for exposed work shall be cast aluminum.

E. Color Selection

Wiring devices, shall be available in standard white, ivory, grey, brown and black. The Engineer will select different colors for various areas and for different devices. No wiring device shall be ordered or installed until the Engineer's final color selections have been made.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install wiring devices in accordance with manufacturer's installation procedures and applicable requirements of NFPA 70 and IEEE 241.

B. In areas where exposed conduit is used, receptacles and switches shall be surface-mounted as shown on the Contract Drawings.

C. Receptacles and switches located in finished areas, where concealed conduit is used, shall be flush-mounted and provided with an approved cover plate, installed level and plumb, with all four corners and edges in contact with the finished surface.

3.02 FIELD TESTS

Prior to energizing circuitry, test wiring for electrical continuity and short circuits. Ensure proper polarity of connections is maintained. Subsequent to energization, test wiring devices to demonstrate compliance with requirements of these Specifications.

3.03 PROTECTION

After receptacles and wall plates have been installed, exercise care in use of convenience outlets. Prior to final inspection, replace devices that have been damaged.

END OF SECTION

SECTION 16510

LIGHTING SYSTEMS

PART 1 - GENERAL

1.01 SUMMARY

This Section specifies requirements for lighting systems.

1.02 QUALITY ASSURANCE

Light assemblies of the type and sizes required shall have been satisfactorily used for purposes similar to those intended herein for not less than three years.

1.03 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in manufacturer's original, unopened, protective packaging.

B. Fixtures shall be wrapped for protection during delivery, storage and handling. Wet or damp wrapping shall be removed, and disposed of, to prevent staining shaft finish.

C. Store materials in original packaging in a manner to prevent soiling and physical damage, prior to installation.

D. Handle in a manner to prevent damage to finished surfaces.

E. Where possible, maintain protective covering until installation is complete and remove such coverings as part of final cleanup.

1.04 SUBMITTALS

Submit the following in accordance with the requirements of "Shop Drawings, Catalog Cuts, and Samples" of Division 1 - GENERAL PROVISIONS:

A. Shop Drawings

One line schematic diagram of dimming system.

B. Catalog Cuts

1. Lighting Fixture

2. Lamps

3. Ballasts

4. Fuse assembly

5. Contactors

6. Dimmer system components

7. Photocells

PART 2 - PRODUCTS

2.01 - MATERIALS

A. General

The Contract Drawings show the location, number, size and type of all lighting fixtures and accessories to be installed under this Contract.

B. Lighting Fixtures

1. General

a. Unless otherwise shown on the Contract Drawings all metallic fixture surfaces shall be degreased, cleaned and coated with a rust inhibitive coating as recommended by the manufacturer. All paint shall be spray applied and baked at 350°F, for at least 20 minutes. Interior surfaces of all fluorescent fixtures shall be white enamel of minimum 87% reflectivity. Finish color of fixtures shall be as selected by the Engineer.

b. Fixtures shall be so designed that ballast coil temperature shall not exceed the UL limit of 105 degrees C. at 40 degrees C. ambient temperature.

2. Fluorescent Fixtures

a. Wiring channels and reflectors shall be of metal not less than 18 gauge, unless otherwise shown on the Contract Drawings or in the Specifications.

b. Minimum gauge metal for the construction of fluorescent fixtures shall be 20 gauge.

3. Exit Lights

a. The exit lights shall be of cast aluminum construction with satin finish aluminum housing and face plate, with drop hinge for easy relamping and shall operate on 120 volts.

b. The exit lights shall be double faced recessed ceiling or wall mounting with directional arrows and 8" red letters on white background. The white background shall be phosphorescent and shall glow for at least 8 hours after loss of power.

4. Incandescent Fixtures

Incandescent fixtures shall be of the type and wattage shown on the Contract Drawings.

5. High Intensity Discharge (HID) Lighting Fixtures

High intensity discharge lighting fixtures shall be of the type, wattage and suitable for the installation shown on the Contract Drawings.

6. Floodlights - Type FD-1

a. Floodlight with die cast aluminum housing, door and integral slipfitter. Reflector shall be aluminum; glass lens shall be heat and impact resistant. The fixture, lamp (type and wattage) and operating voltage shall be as shown on the Contract Drawings. The ballast shall be high power factor, regulated output.

b. The floodlight shall be fully adjustable for an upward illumination and mounted on a base for flat surface installation or on a pole as shown on the Contract Drawings.

7. Emergency Battery Operated Lights

The emergency battery operated lights shall consist of two (2) sealed beam lamps, battery, charger and all necessary equipment to provide for automatic operation in case of failure of normal power. Lights shall be equipped with an indicating lamp and a test switch.

C. Ballasts

1. Ballasts should be designed for the type and number of lamp(s) and voltage as shown on the Contract Drawings.

2. Ballasts shall be designed to be installed and operate in the type fixtures shown on the Contract Drawings.

D. Fuses

Fuses and fuse assemblies shall be as shown on the Contract Drawings.

E. Photo-Time-Controls

1. Lighting timers shall be as shown on the Contract Drawings.

2. Photo control shall be as shown on the Contract Drawings.

3. Time switch shall function to prevent energization of lighting for pre-set periods each day. Time switch dial shall permit different "ON-OFF" settings for each day of the week, with provision for omitting selected days. Time switch shall function within plus or minus 15 minutes of selected time. When permitted by time switch, photo control shall operate to energize whenever natural lighting falls below 25 foot candles.

4. Photo control shall have cadmium sulphide hermetically sealed cell, shall be fully temperature compensated and provide for time delay of at least 15 seconds to prevent false switching. Photo control shall be remotely mounted where indicated, and shall be Tork Series 2100 or approved equal by General Electric or Paragon.

5. Spring driven reserve shall provide sufficient reserve power to operate time switch control at least 16 hours after power failure and, on restoration of power, time switch shall retransfer to synchronous motor drive to automatically rewind reserve.

F. Contactors

1. Contactors shall be of the single coil, electrical operated, mechanically held type. Positive locking shall be obtained without the use of hooks, latches or semi-permanent magnets. Contactors shall be required to make but not break the operating coil current.

2. Main contacts shall be double break silver to silver type protected by arcing contacts. Contacts shall be self-aligning and renewable from the front of the panel.

3. Control connections shall be clearly marked "L" for line wire, "C" for closing wire, and "O" for opening wire. A manual operating lever shall be included.

4. Contactors shall be Underwriters' Laboratories listed at full load rating for use with gas-filled tungsten filament lamps.

5. Each contactor shall be equipped with a control line fuse, coverplate to cover contacts, and one normally open auxiliary contact.

6. Separately mounted contactors shall be housed in sheet steel enclosure. Grouped contactors shall be installed in a common sheet steel enclosure. Enclosures shall be NEMA, unless otherwise shown on the Contract Drawings.

7. Relays for two-wire control shall be provided where required for the specified operation or as shown on the Contract Drawings.

PART 3 - EXECUTION

3.01 INSTALLATION

A. General

1. Inspect all lighting fixtures and accessories prior to installation. Replace any damaged items.

2. In general, install all lighting fixtures and accessories in the locations shown on the Contract Drawings in accordance with manufacturer's recommendations.

3. The Contractor shall furnish and install all fixtures complete with lamps as specified herein. Prior to final inspection the Contractor shall relamp any fixtures where lamps have failed, leaving all in good operating condition.

4. Fixtures shall be carefully supported and aligned with necessary hangers, supporting members and plaster frames for proper installation, all as required and as approved.

5. All fixtures shall be properly wired and connected to branch circuits, tested and left ready for operation.

B. Specific Requirements

1. Every lighting outlet shall have a lighting fixture, unless otherwise directed. In instances where a specific type of fixture has not been assigned to an outlet, provide a complete fixture of the type and wattage designated for outlets of similar function and/or type as directed by the Engineer.

2. Fixtures and/or fixture outlet boxes shall be provided with hangers to adequately support the complete weight of the fixture. Design of hangers and method of fastening other than shown on the Contract Drawings or herein specified shall be submitted to the Engineer for approval.

3. Fixtures mounted on outlet boxes shall be rigidly secured to a fixture stud in the outlet box. Hickies or extension pieces shall be installed where required to facilitate proper installation.

4. All pendant fixtures within the same room or area shall be installed plumb and at a uniform height from the finished floor. Adjustment of height shall be made during the installation. Stems and canopies shall be finished to match the associated fixtures, unless otherwise shown on the Contract Drawings.

5. Units located on exterior of building shall be of weatherproof construction, gasketed and installed with non-ferrous metal screws finished to match the fixture.

6. Lighting fixtures supported by the framing members of a suspended ceiling system shall be securely fastened to the ceiling framing member.

7. All required accessories or hardware that may be required for a complete installation shall be provided.

8. Furnish all necessary additional auxiliary supporting steel for fixtures not mounted on building framework, and where necessary to span the ceiling channels of hung ceiling construction.

END OF SECTION

SECTION 16720

FIRE DETECTION ALARM SYSTEM

PART 1 - GENERAL

1.01 SUMMARY

This Section provides requirements for protective signaling fire alarm system.

1.02 SYSTEM DESCRIPTION

Furnish and install an electrically operated, zoned, supervised, non-coded annunciated fire alarm as specified in this Section and as shown on the Contract Drawings.

1.03 REFERENCES

The following is a listing of the publications referenced in this Section.

Building Officials and Code Adminestrators, Inc. (BOCA)

Federal Specifications

J-C-30	Cable and Wire
W-F-396	Fire Alarm System, Local Electric, Supervised, Selective Coded, Shunt Non-Interferring Type

National Electrical Manufacturer's Association (NEMA) Standards

National Fire Protection Association (NFPA)

NFPA 70	National Electrical Code
NFPA 72A	Local Protective Signaling Systems
NFPA 72D	Proprietary Protectors Signaling Systems
NFPA 72E	Automatic Fire Detectors
NFPA 90A	Air Conditioning and Ventilating Systems

Underwriters Laboratories Inc. (UL)

UL 268	Smoke Detectors for Fire Protective Signaling Systems
UL 268A	Smoke Detectors, Photoelectric Type, Duct Mounted for Fire Protective Signaling Systems

1.04 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in manufacturer's original unopened protective packaging.

B. Store materials in a clean, dry space and protect them from weather.

C. Handle in a manner to prevent damage to finished surfaces.

D. Where possible, maintain protective coverings until installation is complete and remove such coverings as part of final cleanup.

E. Touch up damage to finishes to match adjacent surfaces, including re-coating of galvanized or plated surfaces where damaged, cut or drilled.

1.05 SUBMITTALS

A. Submit the following in accordance with the requirements of "Shop Dravings, Catalog Cuts, and Samples" of Division 1 -GENERAL PROVISIONS:

1. Shop Dravings

Submit layout dravings for dimensioned locations and quantity of each device.

2. Provide wiring and conduit details indicating:

a. Numbered wires and terminals.

b. Size of each conduit and wire.

c. Quantity and locations of each device.

d. Each component to be identified similarly to fire alarm schematic on plans. Provide legend for submittal dravings.

e. Component terminal identification including equipment furnished under other divisions of this Specification, i.e., motorized smoke damper operations shall be included on submittal writing details.

3. Provide a written description of system operations.

B. Brochure

Provide complete brochure information on all components and accessory equipment required by this Section and as shown on the Contract Drawings including but not limited to air duct detectors, fire detectors, control panels, supervisory switches, audio and/or visual signaling devices, alarm panel, shutdown relays, visual signal relay-flasher unit and manual pull stations. All information shall be clearly marked to indicate items provided.

C. Catalog Cuts

1. Air Duct Detectors
2. Fire Detectors
3. Supervisory Switches
4. Audio Signaling Devices
5. Visual Signaling Devices
6. Shutdown relays
7. Visual Signal Relay flasher unit
8. Manual Pull Stations
9. Alarm Panel
10. Control Panel

D. Certified statement that the battery installation conforms to the operating requirements of 2.02 E.

PART 2 - PRODUCTS

2.01 GENERAL

A. The system shall consist of a fire alarm control panel and associated detection and signaling devices as shown on the Contract Drawings and specified in this Section. The Contract Drawings show and this Section specifies a general arrangement of the system and shall not be considered as a complete design. The Contractor shall to provide a complete operable system based on the descriptions of systems and components that he submits for review.

B. All fire alarm equipment, material, devices and assemblies used on this Contract shall be listed and/or labeled by an accepted testing laboratory (UL and FM) for the specific purpose for which they are to be used. The Contractor shall not alter, install or modify such equipment in anyway so as to alter or void the listing or label.

2.02 MATERIAL

A. Control Cabinet

1. Fire alarm control panel shall be of type shown on the Contract Drawings.

2. Panel shall have active zones as required and number of spares shown on the Contract Drawings. Provide signal circuit with not more than nine (9) signaling devices per circuit.

3. Panel shall be of modular construction and shall contain all switches, relays, indicating lamps and necessary apparatus to provide for the complete control and testing of the entire system. Panel shall contain one red alarm and one amber trouble lamp for each zone, buzzer trouble signal, variable voltage signal transformers and auxiliary relays with normally open and normally closed contacts. The panel shall have a remote station module with the capability of transmitting alarm and trouble signals over leased lines to a remote station unit in the future. The panel shall also have smoke reset. Zones shall be as shown on the Contract Drawings. Control cabinet shall be of code gage steel, finished smooth red enamel, equipped with lock and keys. All lamps, silencing, test, and reset switches shall be mounted on the cabinet doors so that all normal operations of the system may be controlled without opening same.

4. Panel where shown on the Contract Drawings shall also have display lights to indicate the status of the mechanical units shown on the Contract Drawings. Display lights shall be green, amber and red to indicate motor operating-normal power, motor off, and motor operating-emergency power, respectively.

C. Provide PYR-A-LARM Type MS-5 fire alarm stations, type indicated on the Contract Drawings, which shall be constructed of molded polycarbonate, finished "Fire Red", with raised lettering in white. The housing for the signal action station, type shown on the Contract Drawings shall accommodate a single action "pull-down" lever.

D. Area smoke detectors

1. Connect base to the control panel.

2. PYR-A-LARM Type Da-3/DA-301/D1-B3/STA-2 shall be used in all air handling plenums and ductwork as indicated on the Contract Drawings or as required by applicable standards. Each smoke damper provided under Division 15 shall be actuated by a plenum smoke detector mounted near the duct in the return air path. Remote indicating lights shall be provided in ceiling to designate a closed smoke detector at each damper location.

3. Provide audible and visual signal devices, distinctive from the sound of other signal devices in the same area. Provide coil winding compatible with the system operating characteristics. Flush mount all signal devices unless otherwise shown on the Contract Drawings. Provide visual signal devices of a distinctive flashing red light. Equipment shall be as specified herein or shown on the Contract Drawings.

E. Power supply

When power supply is shown on the Contract Drawings, the following provisions for the power supply apply:

1. Provide power supplied for 120V normal power, 3 wire supplied from fire alarm disconnect and a standby battery supply for all alarm and detection equipment. Equipment shall be as specified herein and shown on the Contract Drawings.

2. Provide the standby power supply from sealed rechargable lead calcium batteries with an automatic high and trickle charge battery. Batteries shall be sized to operate the system for 24 hours in standby condition (normal operation) and then be capable of sounding or lighting all alarm devices for 20 minutes.

3. Automobile type construction of the vet-cell storage batteries will not be acceptable. Provide vet-cell batteries with an integral hydrometer or similar means of providing a continuous visual indication of the stage of charge and general condition of each cell.

4. All battery installations shall conform to requirements of NFPA 72A.

F. All wire from fire alarm circuits shall be approved for use in either power limited or non-power limited circuits as required below. All other wire is to be of a type and size recommended by the fire alarm equipment manufacturer.

G. Provide remote annunciator as indicated on the Contract Drawings. Annunciator shall annunciate all zones similar to main panel with identical pilot light system. The annunciator shall have a bell silence switch to silence the alarm.

PART 3 - EXECUTION

3.01 Installation

Install all materials in accordance with NFPA 70, and the manufacturer's recommendations. In case of conflict, consult manufacturer before proceeding with installation. Air duct detectors shall be installed in the air ducts of air handling units. Detectors shall be installed downstream of filters and shall be provided with a pair of sampling tubes of the length recommended by the manufacturer, for proper sensitivity and operation.

A. Wiring

1. Provide wiring in accordance with NFPA 70, 72A the manufacturer's requirements and as hereinafter specified. All conductor splices and taps shall be soldered and taped.

2. Detection and signal circuits wiring may be either the non-power-limited type or power-limited type, but the different wire types shall not be mixed in the same raceway. If both types of circuits are to be run in the same raceway, all wiring in the raceway must be the non power-limited type. Other types of circuits shall comply with the applicable portions of the National Electrical Code and shall be installed in raceways separate from detector and alarm circuits if required by the fire alarm system manufacturer.

3. Minimum conduit size shall be provided as required by Table 4, Chapter 9, of the National Electrical Code, using the actual cross-sectional area of the wiring to be installed.

3.02 FIELD TESTING

1. Wiring shall be checked and tested by the Contractor in accordance with the instructions provided by the manufacturer to ensure that the system is free of grounds, opens, shorts, and that insulation resistance between current-carrying conductors and between conductors and ground is one megohm or greater. Upon completion of the installation and on written notification given to the manufacturer or its authorized representative, a factory-trained technician shall be sent to the installation to perform all necessary electrical tests and adjustments and who shall then certify, in writing, that all alarm initiating devices function and conform to the requirements of the Section and the Contract Drawings.

2. The actuation of any signal initiating device shall cause all alarm signals to sound continuously throughout the entire complex until the actuating device is restored to normal and the control panel reset. The appropriate zone lamp shall also light on the control cabinet annunciator. This shall also cause the air handling units in the appropriate buildings to shut down (i.e., if a device in the tower activates, the air handling units in the tower shall shut down). In the event of operating power failure, an open circuit or ground in the system, the system trouble lamp and trouble signal shall actuate. Each zone shall be individually supervised and have its respective zone lamp indicate trouble conditions. The trouble signal may be silenced by switches mounted on the control cabinet door. Upon restoration of the system to normal, the trouble signal shall again sound until the switch is returned to "NORMAL" position. Annunciator panel shall react in the same way as control panel to alarms, except for zone silence switches.

END OF SECTION